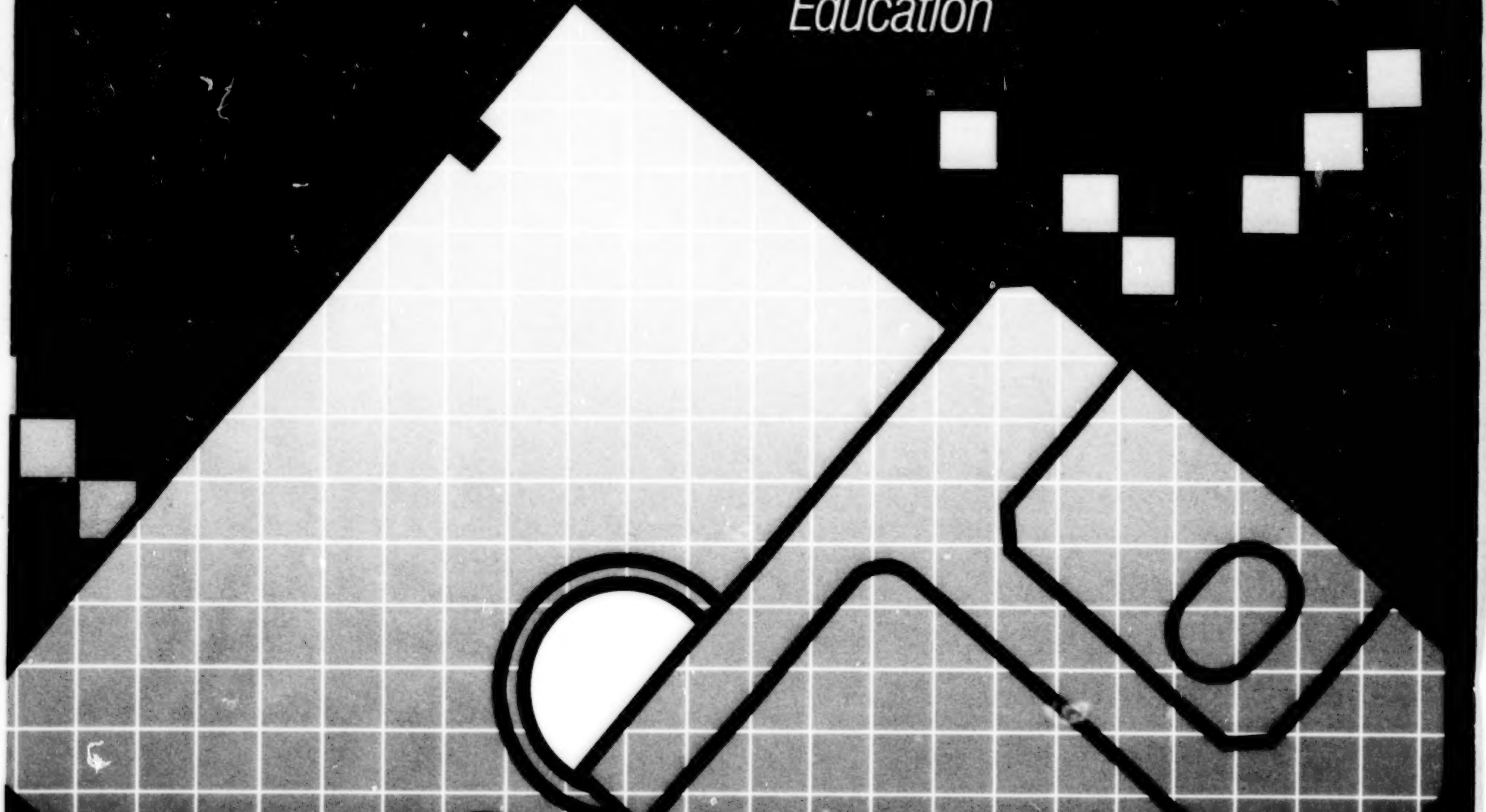
Software

For Aerospace Education



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National Aeronautics and
Space Administration

Software

For Aerospace Education

A Bibliography (Second Edition)

National Aeronautics and
Space Administration

Educational Technology Branch
Educational Affairs Division
NASA Headquarters
Washington, DC 20546

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Table Of Contents

3 Introduction

7 Software Descriptions

65 Additional Software

66 Laser Video Discs

74 Spacelink

78 Appendix A — Vendor List

83 Appendix B — Nasa Teacher Resource Centers

85 Index

Introduction

Microcomputer use in American public schools has grown rapidly since its introduction in the late 1970s. According to Quality Education Data of Denver, CO, 95% of all public schools in the 1987-1988 school year had at least one microcomputer. The ratio of microcomputers to students in those schools is one to 32 which represents nearly a 400% increase from four years ago. The number of public schools having 6 or more microcomputers grew from 50% in the 1985-1986 school year to 70% in the 1987-1988 school year. Microcomputers have emerged from a machine gathering dust in a corner to become an effective educational tool. In classrooms where microcomputers are employed on a one to one ratio with the students, teachers refer to themselves as "managers of learning."

A large share of the credit for effective teaching use of microcomputers certainly goes to the writers and manufacturers of educational software. Literally thousands of learning programs are now available in all grade levels covering virtually all subject areas. So much is available that identifying and choosing the most appropriate software for a specific need can be a difficult process.

To assist educators in identifying software that will meet their objectives and run on the microcomputer systems they have, a variety of bibliographies have been produced. The bibliography that follows is one such effort targeted towards the field of aerospace education. Aerospace education is a general term referring to a variety of educational topics including aviation, space flight, astronomy, remote sensing, orbital dynamics, communications, and rocketry as well as a number of branches within the disciplines of physics, biology, and chemistry.

Bibliography Notes

This is the second aerospace education software bibliography to be published by the NASA Educational Technology Branch in Washington, DC. It follows in a long tradition of service to the educational community of providing high caliber educational materials for teacher training and use in the classroom.

Unlike many software bibliographies, this bibliography does not evaluate and grade software according to its quality and value to the classroom, nor does it make any endorsements or warrant scientific accuracy. Rather, it describes software, its subject, approach, and technical details.

This bibliography is intended as a convenience to educators. The specific software included represents replies to more than 300 queries to software producers for aerospace education programs. Unfortunately, it is inevitable that useful aerospace education software will have been missed. Research for future editions of this bibliography will attempt to expand its coverage as new programs become known.

Structure

The software described in this bibliography represents programs made available to NASA's Educational Technology Branch by software producers and vendors. Additional aerospace education programs were identified but for a number of reasons were not described and have instead been listed in a separate section.

In generating individual software descriptions a variety of conventions were established to provide consistency. It is recommended that users of this bibliography refer to the description form that follows to become familiar with these conventions.

A number of changes have been made in this edition of the software bibliography. Entries have been arranged alphabetically under general headings such as "aviation" and "astronomy." Aerospace education laser video disks and associated software have been included as a new section. Information on connecting with Spacelink, an electronic information service operated for teachers by the NASA Marshall Space Flight Center, has been included. An appendix lists software titles by producer.

Description Form

Title:	Aerospace Education Software Program
Copyright:	The most recent date is included. Some programs are found within the public domain and are indicated as such.
Subject:	One of the following will be listed — Aeronautics Astronomy Rocketry Science Fiction Aerospace Physics Manned Space Exploration Satellites
Application:	One or more school subjects will be listed.
Type:	One or more of the following will be listed — Drill and Practice Game (generally entertainment but with educational application) Simulation Tutorial Utility (data base, astronomical computation, etc.)
Grade Level	Provided by the producer or none recommended (NR). College and adult level is symbolized by the letter A.

Minimum System Requirements:	If versions of the program are available for different computers, each system will be listed. The first system indicated is the one from which the description is generated. Unless otherwise stated, one disk drive is required and the program will run with a monochrome screen. Most programs, however, make use of color graphics. Memory and language requirements will be listed when available.
Description:	One to three paragraphs will describe (not evaluate and grade) the program. The length of the description has no bearing on the program's quality. Generally, simulation descriptions are longer than descriptions for other types of programs.
Components:	Lists the number of disks, user or teacher and student guide materials, backup disk availability.
Features:	Information about copy protection, networking capability, site licensing, or lab pack availability.
Producer:	Name of the producer
Vendor:	Name of the vendor from whom the program can be obtained. Some programs may be available from several vendors. No attempt was made to identify all sources of the software. Rather, the vendor that provided the software or information for this bibliography is listed. Addresses of vendors are included in Appendix A.
Cost:	Prices are for individual copies of software only. Versions of programs for different computers may vary in price. Vendors should be contacted directly for current prices, educational discounts, and ordering information.

Note to Software Producers

This is the second edition of *Software for Aerospace Education—A Bibliography*. We have made every reasonable attempt to identify all available aerospace education software. If you have appropriate software not included in this bibliography or are producing new programs and would like them considered for inclusion in the next edition, please write to the NASA Educational Technology Branch at the following address:

Chief
Educational Technology Branch
Educational Affairs Division
National Aeronautics and Space Administration
Code XE
Washington, DC 20546

Acknowledgement

Software For Aerospace Education - A Bibliography, Second Edition was researched and written under the direction of Mr. William D. Nixon, Chief of NASA's Educational Technology Branch, Educational Affairs Division. The authors wish to extend their grateful thanks to Mr. Nixon for the support and guidance making this directory possible. The authors also wish to thank Dr. Kenneth Wiggins, Project Director, Aerospace Education Services Project, Oklahoma State University, for his continuous support and leadership making this and numerous other aerospace education programs possible. Finally, we extend our thanks to the many educational software companies represented here who provided copies of their products for review

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Section 1: Software Descriptions

Aeronautics

Title: *Aeronautics Disk*

Copyright: 1986
Subject: Aeronautics, Rocketry
Application: Physical Science
Type: Utility
Grade Level: 7 - 12
Minimum System Requirements:
IBM PC, 640K, Basic
Commodore 64/128
Amiga, 512K

Description:

Aeronautics Disk is a series of programs related to the flight of model rockets and hot air balloons. The user is asked for a variety of inputs needed to make performance calculations. The "ATMOS" program determines the properties of a standard atmosphere profile. Programs on single stage model rockets and on rocket gliders determine performance based on inputs such as rocket mass, diameter, engine thrust, launch altitude, air temperature, drag coefficient, and glider wing span. The "BALLOON" program determines the performance of a hot air balloon given its volume, gas temperature, and outside temperature.
Components: 1 disk, backup available, user's guide
Features: Not protected, will run on network
Producer: Science Software
Vendor: Science Software
Cost: $19.95

Title: *ASTROCAD: Performance Analysis for Model Rockets*

(See Rocketry.)

Title: *Aviation and Our Environment*

Copyright: Public Domain
Subject: Aeronautics
Application: Social Studies
Type: Tutorial
Grade Level: 4 - 6
Minimum System Requirements:
Apple II family, 48K

Description:

Aviation and Our Environment is one of three programs in a series titled "Aviation at Work for You." This program discusses and illustrates the many applications of aviation in the modern world. Through the use of extensive graphics and animation, aviation applications in environmental protection, commerce, transportation, police work, agriculture, and emergencies are presented. Aviation careers are discussed. Occasional questions test the user's understanding of concepts presented. (Also see *Principles of Flight* and *Navigation and Flight Planning*.)
Components: 3 disks, user information sheet, user makes own backup
Features: Not protected
Producer: Federal Aviation Administration
Vendor: Federal Aviation Administration*
NASA Teacher Resource Centers**
Cost: Free

*The FAA will copy blank disks. Educators should send 7 blank disks to the FAA for copying and return by mail. Two additional aviation programs will be copied: *Principles of Flight* and *Navigation and Flight Planning*.

**Contact the NASA Teacher Resource Center that serves your state for details.

Title: *Chuck Yeager's Advanced Flight Simulator*

Copyright: 1987
Subject: Aeronautics
Application: Physics
Type: Simulation Tutorial
Grade Level: NR
Minimum System Requirements:
IBM PC family, 64K
Commodore 64/128
Macintosh
Apple II family 64K
Tandy 1000, 1000 SX I1000EX ST
require DOS 2.0 or higher

Description:

In *Chuck Yeager's Advanced Flight Simulator,* a 3-level tutorial teaches basic flying skills, then progresses to advanced maneuvers and aerobatic stunts. Students follow Yeager's lead through obstacle courses while a Flight Recorder stores student stunt flying patterns. A test pilot option is available. This allows students to evaluate 14 aircraft ranging from historic planes to modern or experimental craft. An Airplane Racing option that allows competition over one of six race courses is also available.
Components: 1 disk, manual and reference card, unprotected backup available for $10.00
Features: Protected
Producer: Electronic Arts
Vendor: Electronic Arts
Cost: $39.95

Title: *Aerodynamics of Model Rockets*

Copyright: 1986
Subject: Aeronautics, Rocketry
Application: Earth Science, Physical Science
Type: Tutorial
Grade Level: 7 - A
Minimum System Requirements:
Apple II family, 64K

Description:

Flight: Aerodynamics of Model Rockets is a series of seven programs on model rocketry and aerodynamics. The programs serve as an introduction to the forces of aerodynamics as they apply to airplane and model rocket flight. Each program concept is supplemented with graphical illustrations and animation. Review questions are imbedded in each of the programs for self testing. Topics include aerodynamics, drag, center of gravity/pressure, stability, and forces on flying objects.
Components: 2 disks, user makes own backup, user's guide, teacher's guide, three posters available
Features: Not protected
Producer: Estes Industries
Vendor: Estes Industries
Cost: $44.95

Title: *Flight Simulator II*

Copyright: 1983
Subject: Aeronautics
Application: Aeronautics, Physical Science
Type: Simulation
Grade Level: NR
Minimum System Requirements:
Apple II family, 48K
Atari & ST, 64K/512K
Commodore 64
Amiga, 64K/521K

Description:

Flight Simulator II turns the user into the pilot of a Piper 181 Cherokee Archer, single engine, fixed landing gear aircraft. The pilot controls the flight through the keyboard or with a joystick and keyboard. The monitor is divided into two screens. One shows the instrument panel of the aircraft featuring 49 displays, including air speed indicator, reciprocal heading indicator, fuel gages, and altimeter. The other screen is an out-the-window view showing a simulated 3D scene as would be seen by a pilot in an actual airplane. The scene changes with changes in altitude and heading. The view direction can be changed or switched with a radar screen that shows a straight down view. A typical flight begins at Meigs Field in Chicago, IL, but an editor function permits changing to any of 70 different airports by changing coordinates and altitude from a data table.

Title: *Flight Simulator II (continued)*

Takeoff is accomplished by throttling the engine up to full power and taxiing along the runway until flight speed is reached. Keyboard or joystick controls operate elevators, flaps, and ailerons. The user is able to navigate to other airports and land or perform aerobatics. The editor function permits changing the preset weather conditions for more challenging navigation problems. Optional scenery disks are available to increase the flying environment by adding many new airports widely spaced across the United States. For experienced *Flight Simulator II* pilots, a simulated World War I aerial battle game can be played that features dogfights and bombing runs.
Components: 1 disk, user's manuals and flight charts, backup disk
Features: copy protected, Amiga version not protected
Producer: subLOGIC Corporation
Vendor: subLOGIC Corporation
Cost: $49.95, $19.95 (Scenery Disks)

Title: *Glidepath*

Copyright: 1985
Subject: Aeronautics
Application: Physical Science
Type: Simulation
Grade Level: 6 - 9
Minimum System Requirements: Apple II family, 64K

Description:

Glidepath is an aerodynamic simulator program that permits the user to create and test fly glider designs. The program comes with 5 designs stored in a data base and room for 25 additional user-developed designs that can be cleared from memory when desired. The user may chose to test fly any of the supplied designs over 5 varying terrains or redesign a glider first. Wing span, wing cord (width), total length, and wing center each can be adjusted for test flights. A top view diagram of the glider shows adjustments as they are made. Just prior to test flights, pitch, velocity, and altitude are preselected by the user. During tests, animation simulates the flight of the glider over the selected terrain while a data bar at the bottom continuously displays pitch, attack velocity, altitude, range, and wind. A pitch indicator in the upper right of the screen shows the tilt of the glider during flight. One objective of the activity is to break the "world record" distance flown by one of the supplied designs. Users are encouraged to compare details of the supplied glider designs to identify the best configurations for their own designs.
Components: 1 disk, backup, teacher/user's guide
Features: Copy protected, lab pack available
Producer: HRM Software
Vendor: HRM Software
Cost: $69.00

Title: *Jet*

Copyright: 1985
Subject: Aeronautics
Application: Physical Science
Type: Simulation
Grade Level: NR
Minimum System Requirements: IBM PC family, 128K, color graphics monitor adapter, color graphics card

Description:

Jet is the IBM version of *Flight Simulator II*. The user becomes the pilot of an F-16 land-based or an F-18 carrier-based aircraft. By operating keyboard controls or a joystick, the user throttles up the aircraft's engines, operates the elevators and ailerons, and accelerates for a high-G takeoff. Various heads-up flight displays on the monitor screen provide essential flight data including altitude, air speed, thrust, fuel, heading, radar, and range. Menu options permit the user to travel in free flight for piloting and sightseeing experience or participate in aerial warfare including dogfights and target strikes. Optional scenery disks, available separately, permit the user to operate from many different airports across the United States. Scenery disks display generalized local geography for sightseeing tours and takeoff and landing practice at specific airports. Special scenery disks feature detailed geographic and cultural features of relatively small areas.
Components: 1 disk, user's guide, backup disk available
Features: Protected
Producer: subLOGIC
Vendor: subLOGIC
Cost: $49.95

Title: *Navigation and Flight Planning*

Copyright: Public Domain
Subject: Aeronautics
Application: Mathematics, Physical Science
Type: Tutorial
Grade Level: 4 - 6
Minimum System Requirements: Apple II family, 48K

Description:

Navigation and Flight Planning is one of three programs in a series titled "Aviation at Work for You." This program explains the method by which aircraft navigate from one place to another. Compass headings, air speeds, and the mathematics employed in navigation are explained through text, graphics, and animation. Occasional questions test the user's understanding of concepts presented. (Also see *Principles of Flight* and *Aviation and Our Environment)*
Components: 1 disk, user information sheet, user makes own backup.
Features: Not protected
Producer: Federal Aviation Administration
Vendor: Federal Aviation Administration*
NASA Teacher Resource Centers**
Cost: Free

*The FAA will copy blank disks. Educators should send 7 blank disks to the FAA for copying and return by mail. Two additional aviation programs will be copied: *Principles of Flight* and *Aviation and Our Environment*.

**Contact the NASA Teacher Resource Center that serves your state for details.

Title: *Principles of Flight*

Copyright: Public Domain
Subject: Aeronautics
Application: Physical Science
Type: Tutorial
Grade Level: 4 - 6
Minimum System Requirements:
Apple II family, 48K

Description:

Principles of Flight is one of three programs in a series titled "Aviation at Work for You." This program explains the physical principles that make airplane flight possible. The parts of an airplane are identified and their functions explained. Text, graphics, and animation are used to explain thrust, drag, lift, gravity, and how elevators, ailerons, and the rudder are used for control. Occasional questions test the user's understanding of concepts presented. (Also see *Navigation and Flight Planning* and *Aviation and Our Environment*)
Components: 3 disks, user information sheet, user makes own backup
Features: Not protected
Producer: Federal Aviation Administration
Vendor: Federal Aviation Administration*
NASA Teacher Resource Centers**
Cost: Free

*The FAA will copy blank disks. Educators should send 7 blank disks to the FAA for copying and return by mail. Two additional aviation programs will be copied: *Navigation and Flight Planning* and *Aviation and Our Environment*

**Contact the NASA Teacher Resource Center that serves your state for details.

Aerospace Physics

Title: *Explorer Metros*

Copyright: 1982
Subject: Aerospace Physics
Application: Earth Science, Physical Science
Type: Game
Grade Level: 2 - 9
Minimum System Requirements: Apple II family, 48K

Description:

Explorer Metros gives practice in metric measurement estimation skills. The player is a member of the crew of an explorer spaceship called the "Metros." The ship has been sent to the planet Mars because of a recent discovery of a bright object in orbit about the planet. The object turns out to be a huge abandoned space colony. The player leads an exploration party to the interior of the colony and has to make a number of decisions based on the player's metric measurement estimating ability before reporting back to the explorer ship in eight hours. A robot assistant can be called on to help in the decision making process and information about metric measurement can be retrieved from a data base when needed. Poor answers and consultations with the robot result in time penalties.
Components: 1 disk, backup, teacher's guide
Features: Copy protected, Lab pack available, District plan available, Corvus network version available
Producer: Sunburst Communications Inc.
Vendor: Sunburst Communications Inc.
Cost: $59.00

Title: *Gravity*

Copyright: 1984
Subject: Aerospace Physics
Application: Earth Science, Physical Science
Type: Simulation
Grade Level: 9 - A
Minimum System Requirements: IBM PC family, 128K, DOS 1.1

Description:

Gravity simulates the complex interactions between the gravitational fields of moving bodies in space. The user selects the number of bodies to be simulated, ranging from 1 to 9, their masses, initial starting position on the screen, and vector velocity. Other simulation parameters such as plotting speed and magnification are also chosen. All selected bodies move around the screen according to the interactions of their gravitational fields. If desired, the center of mass can be kept in the screen's center to simulate the effect of the Sun on bodies in the solar system. Bodies can collide and become captured by mutual gravitational fields and orbit each other. Orbital simulations representing motions in the actual solar system can be developed. The effects of changing a body's mass can be demonstrated by reprogramming the simulation through the use of special function keys.
Components: 1 disk, user's guide, user makes own backup
Features: Not protected, lab pack and site license available
Producer: Cross Educational Software
Vendor: Cross Educational Software
Cost: $40.00

Title: *Microgravity — An Operation Liftoff Project: GO — Gravity and Orbits*

Copyright: Public Domain
Subject: Aerospace Physics
Application: Earth Science, Physical Science
Type: Tutorial
Grade Level: 5 - 6
Minimum System Requirements:
Apple II family, 48K

Description:

Microgravity deals with the forces of gravity and motion as they are applied to spaceflight. The program first acquaints the user with the mathematics of squares, inverses, and inverse squares and leads into Newton's Universal Law of Gravitation. The differences between mass and weight are described as well as various topics such as the period of an orbiting body vs. altitude, escape velocity, and orbital velocity. Self tests are given to check understanding of concepts and two ten-question exams are administered with scores stored in a records keeping file for use by the teacher.

GO (gravity and orbit) on the second side of the disk calculates altitude and periods, gravity in space, orbital velocity, and escape velocity for points on or about the planets and several of the principle moons in the solar system. Calculations are performed in English or metric units.

Components: 1 disk, teacher's guide, student's guide, resource publications
Features: Unprotected
Producer: NASA Jet Propulsion Laboratory
Vendor: NASA Jet Propulsion Laboratory
Cost: $20.00

Title: *Newton's Third Law*

Copyright: 1986
Subject: Aerospace Physics
Application: Physical Science
Type: Tutorial
Grade Level: 6 - 12
Minimum System Requirements:
Apple II family, 48K
IBM PC Jr, DOS 2.0 or 2.1, 128K
Tandy 1000, Tandy DOS

Description:

Newton's Third Law is a tutorial program that makes extensive use of color graphics and animations to illustrate and explain action, reaction, friction, mass, velocity, and momentum. Much of the program centers around two pirates that are attempting to move boats. After basic concepts are established, the program moves on to explaining rocket flight and how net force and momentum are calculated. A glossary is available when needed to explain terms used by Newton in his third law. At the completion of the program a ten-question quiz is given to evaluate the user's understanding of the concepts presented. A record-keeping function for the teacher permits the storage of test scores for 100 students.

Components: 2 disks, backups, teacher's guide
Features: Copy protection, lab packs available, record keeping
Producer: Prentice-Hall Courseware
Vendor: Prentice Hall Allyn & Bacon
Cost: $69.00

Title: *Physics*

Copyright: 1987
Subject: Aerospace Physics
Application: Physics
Type: Tutorial
Grade Level: 9 - 12
Minimum System Requirements: Apple Macintosh 512K, requires 800K drive, 2 400K drives, or hard disk

Description:

Physics provides a comprehensive study of the concepts involved in classical mechanics. It includes over 300 problems that are compatible with most physics curricula. Students manipulate vectors, interpret graphs, experiment with velocity and position to see change in orbital position, and may work with kinetic and potential energy simulations.
Components: 1 disk, backup, user's guide
Features: Protected
Producer: Sensei
Vendor: Broderband Software
Cost: $99.95

Title: *The Physics Disk*

Copyright: 1985
Subject: Aerospace Physics
Application: Physics
Type: Simulation
Grade Level: NR
Minimum System Requirements: Apple II family, 48K

Description:

The Physics Disk is designed to be used as a supplement to traditional teaching of physics. Simulations and demonstrations of concepts from the mathematical methods of Physics, Mechanics, Thermodynamics, Electromagnetism, Wave Phenomena, and Modern Physics are found in this software package. The manual is very complete and details each step both technically and conceptually.
Components: 1 disk, manual, backup available
Features: Not protected
Producer: Prentice Hall
Vendor: Prentice Hall
Cost: $36.75

Title: *The Physics of Model Rocketry*

(See Rocketry.)

Title: *Ray Tracer*

Copyright: 1982
Subject: Aerospace Physics
Application: Earth Science
Type: Simulation
Grade Level: 9 - 12
Minimum System Requirements: Apple II family, 48K

Description:

Ray Tracer presents students with a game to demonstrate the wave-particle properties of light. The program provides several options for student manipulation when drawing ray diagrams: Straight interface, thin lens, thick lens, two thin lenses, spherical raindrop, plane mirror, spherical mirror, and single refracting surface. The object of the simulation is to hit a target by moving the light source and angle in as few tries as possible.
Components: 1 disk, teacher's guide
Features: Protected
Producer: Vernier Software
Vendor: Vernier Software
Cost: $24.95

Title: *Simon*

Copyright: 1985
Subject: Aerospace Physics
Application: Physics
Type: Simulation
Grade Level: NR
Minimum System Requirements:
Apple II family, 48K

Description:

Simon demonstrates the concepts involved in Newton's second and third laws. In the program, the user applies a force to a box for a certain length of time and sees the results of the force on the person and the box. Variables include the amount of force, mass of the box, and the frictional coefficient of the person. The results of the action are presented both numerically and graphically.
Components: 1 disk, backup, user's guide
Features: Not protected
Producer: Micro Innovations
Vendor: Prentice Hall
Cost: $36.75

Title: *Sir Isaac Newton's Games*

Copyright: 1985
Subject: Aerospace Physics
Application: Physical Science
Grade Level: 4 - A
Type: Game
Minimum System Requirements:
Apple II family, 64K
IBM PC Jr., 128K, color graphics card
Tandy 1000, 256K

Description:

Sir Isaac Newton's Games demonstrates differences in motion on Earth and in space through a series of five activities. In the "track" game the user attempts to move a marker, with keyboard controls, through a racetrack course set on Earth where friction is a factor, in space near the Sun where gravity is a factor, or out in deep space where friction and gravity do not have an effect. Other games require moving a marker around an obstacle course, pit two players in a race or in a round of tag, or challenge users to write their names. The different activities attempt to develop an intuitive sense in the user of motion, action-reaction, gravity, friction, momentum, and acceleration.
Components: 1 disk, backup, teacher's guide
Features: Copy protected, Lab pack available, District plan available, Corvus network version available
Producer: Sunburst Communications Inc.
Vendor: Sunburst Communications Inc.
Cost: $59.00

Title: *Telescopes*

Copyright: 1985
Subject: Astronomy, Aerospace Physics
Application: Earth Science, Mathematics, Physical Science
Type: Tutorial
Grade Level: 9 - A
Minimum System Requirements: Apple II family, 64K

Description:

Telescopes is a text and diagram tutorial program on the optics and properties of astronomical telescopes. The principles of refraction and reflection as they relate to lenses and mirrors are described. Other topics include focus, magnification, light gathering power, resolving power, and the relative merits and disadvantages of refracting and reflecting telescopes. The mathematics for figuring magnification, light gathering power, and resolving power are demonstrated. The user is given several sample problems to solve. A 13-question self-test on telescopes concludes the program.

This program is one of four parts in an astronomy computer program series and is available individually or with the rest of the series. Other titles in the series: *Eclipses of the Sun and Moon, The Solar System, Time and Seasons.*
Components: 1 disk, backup
Features: Copy protected, multiple backups may be available
Producer: Educational Images Ltd.
Vendor: Educational Images Ltd.
Cost: $33.75

Title: *Unprintable Physics*

Copyright: 1985
Subject: Aerospace Physics
Application: Physics
Type: Simulation
Grade Level: NR
Minimum System Requirements: Apple II family, 48K

Description:

Unprintable Physics is intended as a supplement to traditional teaching of physics. The simulations and demonstrations represent the concepts found in the following menu choices: Mathematical Methods, Mechanics, Thermodynamics, Electromagnetism, Wave Phenomena, and Modern Physics. A complete manual is included.
Components: 1 disk, user's manual
Features: Not protected
Producer: Prentice Hall
Vendor: Prentice Hall
Cost: $36.75

Astronomy

Title: *All About the Solar System*

Copyright: 1987
Subject: Astronomy
Application: Earth Science
Type: Tutorial
Grade Level: 4 - 6
Minimum System Requirements:
Apple II family, 48K

Description:

All About the Solar System presents information on the Sun, Earth, Moon, inner planets, and the other planets. The lessons are presented in a tutorial format with text and graphics. Students interact with the program utilizing probes to search for information. The program contains games that involve identification, spelling, and vocabulary. A quiz generates multiple choice and true/false questions. A comprehensive teacher's guide, containing background information and teaching suggestions, is included.
Components 1 disk, teacher's guide with reproducible worksheets, backup disk available
Features: Protected, lab pack available
Producer: Ventura Educational Systems
Vendor: Ventura Educational Systems
Cost: $49.95

Title: *Apple Public Domain Astronomy Software*

Copyright: Public Domain
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: 3 to A
Minimum System Requirements:
*Apple II family, 48K or 64K

Description:

Apple Public Domain Astronomy Programs consists of three disks (six sides). The majority of offerings on the disks are observatory utility programs providing a variety of calculation functions including rising and setting times, planet locations, eclipse dates, calendar conversions, and astrophotography data. Educational programs include The "Griffith Observatory Museum Disk" which contains an astronomy term hangman game, a space exploration and astronomy quiz, and a program about the user's birth dates on the planets. Also included is "The Astronomical Almanac" developed for the Hartford County, MD schools. With this program, the user enters the current calendar date and geographic location and is able to call up a variety of data tables, useful for actual observation, on the positions of the planets, local rising and setting times of the Sun, Moon, and planets, and length of daylight.
*Memory requirements vary for the three disks
Components: 3 disks, information sheets
Features: Not protected
Producer: Public domain sources
Vendor: John Mosley
NASA Regional Teacher Resource Centers**
Cost: $10.00 (from John Mosley)
**Contact the NASA Teacher Resource Center that serves your state for details.

Title: *Astro-Aid*

Copyright: 1986
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: 6 - A
Minimum System Requirements:
IBM PC family, 128K
Commodore 64/128
Apple II family, 64K

Description:

Astro-Aid contains 44 astronomical functions: coordinate conversions, time conversions, basic conversions (such as distances, temperatures, energy), percussion, mutation, aberration, parallax, refraction, Kepler's/ Newton's Laws, Relativity, Trigonometry, telescope design, equinox/ solstice, Polaris Transits, Jupiter's moons, solar system data, constellations, and stars.
Components: 1 disk, user makes own backup, user's manual
Features: Not protected, lab pack, site licensing and networking available
Producer: Zephyr Services
Vendor: Zephyr Services
Cost: $29.95

Title: *Astro-Computer (Astronomy) Data Bytes*

Copyright: 1985
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: NR
Minimum System Requirements:
Apple II family, 48K

Description:

Astro-Computer (Astronomy) Data Bytes contains a data bank of astronomy facts. Information on comets, asteroids, meteors, moons, planets, stars, celestial phenomena, discoveries, events, and instruments. The package includes many color diagrams and charts using high resolution graphics. Accompanying the software is an in-depth fact booklet, *Astronomy*. It is a complete compliment to the software containing basically the same information.
Components: 2 disks, backups, fact booklet
Features: Protected, lab pack, site licensing and networking available
Producer: Hubbard Scientific
Vendor: Hubbard Scientific
Cost: $59.95

Title: *Astro-Finder*

Copyright: 1987
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: NR
Minimum System Requirements:
IBM PC with CGA or EGA graphics, any graphics printer

Description:

Astro-Finder is a two-diskette package containing many options and features. Among them, users may select the time, date, longitude, and latitude for sky viewing. Star charts may be printed in four different formats: ultra-plots 7" x 10" with 1/8 degree resolution, coordinate grids on charts or as separate charts, batch move to print up to 20 charts, and linearized Transverse Mercator Projections for charts. Auto-Retrieval of objects to the screen or charts is available.
Components: 2 disks, user makes own backup, user's manual with 14-page star atlas
Features: Not protected, lab pack, site licensing and networking available
Producer: Zephyr Services
Vendor: Zephyr Services
Cost: $69.96

Title: *Astro-Macronomer*

Copyright: Public Domain
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: NR
Minimum System Requirements:
Macintosh, 400K

Description:

Astro-Macronomer is an astronomical observation utility program providing coordinate, magnitude, and other pertinent data about the Sun, Moon, planets, stars, and deep space objects such as galaxies, clusters, and nebulae. The user may read listings for all objects of a selected type or search for a particular object by entering its Messier number, New General Catalog number, constellation name, or coordinates. The data files of the program can be edited and the default settings for the observer's time and location can be adjusted. Printouts of any data page may be made.
Components: 1 disk, user makes own backup, user's guide
Features: Not protected
Producer: GraySoft
Vendor: GraySoft
Cost: $5.00*
*Distributed under "ShareWare." Send self-addressed stamped envelope and blank disk.

Title: *Astrobase*

Copyright: 1986
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: 6 - A
Minimum System Requirements:
IBM PC family, 128K
Commodore 64/128
Apple II family, 64K

Description:

Astrobase contains a database of 300 astronomical objects beyond our solar system. Users may add 700 additional objects (400 on the Apple version.) Included in the database are Galaxies, Open Star Clusters, Globular Star Clusters, Emission Nebula, Dark Nebula, Planetary Nebula, Double Stars, Variable Stars, Quasars, and Special Stars. Users may search for types of objects and display or print the results. The software may be used as an observation log to record date, conditions, and other information.
Components: 1 disk, user makes own backup, user's manual
Features: Not protected, lab pack, site licensing and networking available
Producer: Zephyr Services
Vendor: Zephyr Services
Cost: $29.95

Title: *Astrocalc*

Copyright: 1987
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: NR
Minimum System Requirements:
Apple II family, 64K
Commodore 64/128
IBM PC, PC-AT, PC-XT, 128K

Description:

Astrocalc contains a database that allows users to input time, day, month, latitude, and longitude. The software calculates the following for the Sun, Moon, and all planets: Right Ascension and Declination, Altitude and Azimuth, Ecliptic Latitude and Longitude, Angular Size, Phase, Fractions Illuminated, Elongation from the Sun, Rise/Set Times, Orbital Elements for each body, Brightness, Magnitude, and Distance from the Earth. Also provided are Local Standard Time, Greenwich Mean Time, Local Sidereal Time, Greenwich Sidereal Time, Solar Equation of Time, and Twilight Star/End Times.
Components: 1 disk, user's manual, user makes own backup
Features: Not protected, lab pack, site licensing and networking available
Producer: Zephyr Services
Vendor: Zephyr Services
Cost: $29.95

Title: *Astrografix*

Copyright: Public Domain
Subject: Astronomy
Application: Earth Science
Type: Utility, Game
Grade Level: NR
Minimum System Requirements:
Apple II family, 48K

Description:

Astrografix is a collection of astronomy utility, game, data base, and graphic programs. Menu selections available include sunrise/sunset times, Moon plotter, planet orbits and coordinates, northern starfield, zodiac constellations, star and nebula locations, and an orbital plotter for different solar masses. The game program permits the user to learn about different planets and then identify mystery planets based upon clues such as weight or mass.
Components: 1 disk, user makes own backup
Features: Not protected
Producer: Houston Museum of Natural Science
Vendor: NASA Teacher Resource Centers*
Cost: Free
*Contact the NASA Teacher Resource Center that serves your state for details.

Title: *Astrolab*

Copyright: 1986
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: NR
Minimum System Requirements:
IBM PC, PC-AT, PC-XT, 256K, color graphics card

Description:

Astrolab is a computer version of the ancient astrolab and serves as a planisphere to display the Sun, Moon, 8 planets, 1 comet, 88 constellations, deep space objects, and various coordinates. The program will display the astronomical sky for any location on Earth after the user enters the appropriate geographic and time data. The user can manipulate the sky to future or past dates with corresponding changes in the stellar background, Sun, Moon, and planetary positions. When desired, constellations can be highlighted. Unknown objects can be identified by moving a cross hair to their location. Information about the object's magnitude, distance, and coordinates are displayed. Information tables may be called up

Title: *Astrolab*
(continued)

providing information on sidereal time, planet positions and phases, sunrise and sunset times, solar transits, eclipse warnings, and more. The data base may be expanded by the user.
Components: 1 disk, user makes own backup, user's manual
Features: Not protected
Producer: Cygnus
Vendor: Cygnus
Cost: $50.00/$60.00 for computers equipped with an 8087 math co-processor.

Title: *Astronomy Data Bases*

Copyright: 1987
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: 5 - A
Minimum System Requirements:
Must be used with Bank Street School Filer
Apple II family, 64K
Commodore 64

Description:

Astronomy Data Bases contains a database file on the planets, a file containing a weekly log of solar, lunar, tidal, and temperature data, and a time line file of important events in the history of astronomy. The eight data bases contained in the program are designed to be used with Bank Street School Filer. They are Time line, Pre-1800, Post-1800, Planets, Log, Books, Glossary, and Constellations.
Components: 1 disk, backup, teacher's guide, lesson plans, reproducible worksheets
Features: Copyable database disk, lab pack available
Producer: Sunburst
Vendor: Sunburst
Cost: $59.00

Title: *Astronomy Disk*

Copyright: 1986
Subject: Astronomy
Application: Earth Science
Type: Utility, tutorial
Grade Level: 7 - 12
Minimum System Requirements:
IBM PC, 640K, BASIC
Commodore 64/128
Amiga, 512K

Description:

Astronomy Disk is a series of astronomical programs that teach various concepts and make calculations. Included is a tutorial that solves Kepler's equations for eliptic, parabolic, and hyperbolic orbits. Another tutorial explains the relationships between Julian and Gregorian calendar dates and sidereal and solar times. Other programs calculate the positions of the Sun, Moon, planets, stars, and occurrences of eclipses. Calculation programs require user input of latitude and longitude and date and time.
Components: 1 disk, backup available, user's guide
Features: Not protected, will run on network
Producer: Science Software
Vendor: Science Software
Cost: $34.95

Title: *The Astronomy Disk*

Copyright: 1985
Subject: Astronomy
Application: Earth Science
Type: Simulation
Grade Level: NR
Minimum System Requirements:
Apple II family, 48K

Description:

The Astronomy Disk is intended to present demonstrations and simulations to students studying astronomy. The concepts included are the Earth's Satellite, Multi-Stage Rocket, Expedition to Mars, Elliptical Orbit, Starship, Jupiter's Moons, Satellites, Comets, Solar System, Temperature and Color Spectral Types, Build a World, Double Stars, Inside Stars, Evolution of Stars, and Spiral Galaxies. A very complete manual is included.
Components: 1 disk, user's manual, backup available $14.75
Features: Protected
Producer: Prentice Hall
Vendor: Prentice Hall
Cost: $36.75

Title: *Astronomy For Everyone*

Copyright: 1985
Subject: Astronomy
Application: Earth Science
Type: Tutorial
Grade Level: 3
Minimum System Requirements:
Apple II family, 48K

Description:

Astronomy for Everyone describes the origin, composition, and characteristics of comets, meteors, and asteroids. Six lessons cover general information regarding comets: Halley's Comet; the lesser comets; meteoroids, meteors, and meteorites; asteroids; and telescopes and observatories. Students view information that includes animated sequences then answer questions. Work sheets accompany every lesson.
Components: 1 disk, backup, user's manual, reproducible worksheet
Features: Protected, site licensing available
Producer: SRA
Vendor: SRA
Cost: $49.95

Title: *Astronomy: Stars for All Seasons*

Copyright: 1983
Subject: Astronomy
Application: Earth Science
Type: Tutorial/Simulation
Grade Level: 5 -10
Minimum System Requirements:
Apple II family, 48K
TRS 80, 32K

Description:

Astronomy: Stars for All Seasons provides monthly sky maps that allow users to view 34 constellations from any latitude in the northern hemisphere. The tutorial section of the program explains the concepts of seasonal change. An astronomical chart gives the magnitude, declination, right ascension, and light years from Earth for each star.
Components: 1 disk, backup, user's manual
Features: Protected, lab pack and site licensing available
Producer: Educational Activities
Vendor: Educational Activities
Cost: $59.95

Title: *Astrostell*

Copyright: 1986
Subject: Astronomy
Application: Earth Science
Type: Tutorial
Grade Level: NR
Minimum System Requirements:
IBM PC family, 128K
Apple II family, 64K
Commodore 64/128

Description:

Astrostell helps users identify the 88 constellations plus the deep sky objects they contain. Included in the program are the following features: students may call up a constellation by name; guess constellations presented at random; study both the name and magnitude of stars, deep sky objects, and classical lore for each constellation. In addition, users may call up a list of constellations visible on specific date, time, latitude, and longitude.
Components: 1 disk, user makes own backup, user's manual, instruction card
Features: Unprotected, lab pack, site licensing and networking available
Producer: Zephyr Services
Vendor: Zephyr Services
Cost: $29.95

Title: *Celestial Basic*

Copyright: 1984
Subject: Astronomy
Application: Earth Science
Type: Utility, Tutorial
Grade Level: 8 - A
Minimum System Requirements:
Apple II family, 48K
IBM PC and compatible, 64K, MS-DOS
Commodore 64

Description:

Celestial Basic is primarily an almanac of astronomical data. The program is contained on two sides of a single disk and provides extensive data for astronomical observations including lunar eclipses, moonrise and moonset, lunar phases, positions of the Moon and planets, Jupiter Galilean satellite positions, and worldwide horizon maps of the sky. The user can request data for a specific date and in some cases for a specific longitude and latitude. Additional programs provide information on calendars, sidereal time, and meteor showers. An astronomical conversion program converts various astronomical measurements into English and metric units and back. A text file providing information about the solar system and constellation name quiz is also present.
Components: 1 disk (2 sides), user makes own backup, user's guide
Features: Not protected
Producer: S & T Software Service
also published by Dynacomp
Vendor: S & T Software Service
Cost: $49.95

Title: *Celestial Simulation*

Copyright: 1986
Subject: Astronomy
Application: Earth Science, Physics
Type: Tutorial, Simulation
Grade Level: 6 - 9
Minimum System Requirements:
Apple II family, 48K

Description:

Celestial Simulation is designed to show students the motion of planets as they travel through space with high resolution, three-dimensional simulations. Additionally, astrological concepts presented to students include Ptolemaic Theory, the Earth's satellite, moon phases, eclipses, the Northern sky, comets, asteroid flight, interstellar flight, Kepler's Third Law, eccentricity, and breaking out of the Earth's gravitational field. Students have the opportunity to create a simulation of a three-planet solar system.
Components: 2 disks, user's manual, backup available
Features: Protected, lab pack, site licensing available
Producer: Intellectual Software
Vendor: Queue
Cost: $24.95

Title: *Ceres: A Space Odyssey*

Copyright: 1985
Subject: Astronomy
Application: Earth Science
Type: Tutorial
Grade Level: NR
Minimum System Requirements:
Apple II family, 48K

Description:

Ceres: A Space Odyssey is a tutorial program that introduces elementary age students to the solar system. The students are presented with multiple choice questions and must answer properly to proceed. A test section is included with a teacher management section, allowing the teacher to assign ID numbers to students for review of grades earned on the test.
Components: 1 disk
Features: Not protected
Producer: Delapress, Inc.
Vendor: Delapress, Inc.
Cost: $19.00

Title: *Cometwatch*

Copyright: 1986
Subject: Astronomy
Application: Earth Science
Type: Tutorial, Utility
Grade Level: NR
Minimum System Requirements:
IBM PC family, 128K
Apple II family, 64K
Commodore 64/128

Description:

Cometwatch provides historical information regarding comets and how to observe and photograph them. Special emphasis is given to Halley's Comet and activities for using the program are included. In addition, some calculations are provided: on-screen plot of any comet orbit, Halley's position in the sky, and the Plot of Halley and the Earth around the sun for any return, past or present.
Components: 1 disk, user makes own backup, user's manual, instruction sheet
Features: Not protected, lab pack, site licensing and networking available
Producer: Zephyr Services
Vendor: Zephyr Services
Cost: $29.95

Title: *Computer Star Games - Stellar 28*

Copyright: 1985
Subject: Astronomy
Application: Earth Science
Type: Game
Grade Level: 5 - A
Minimum System Requirements:
Apple II family, 48K

Description:

Computer Star Games - Stellar 28 has a game format that teaches students to identify over 100 stars and constellations. There are over 18 games provided in the package. The Stellar 18 Constellation Game may be purchased separately or in combination with the software. It is designed to reinforce the information presented to the user by the software.
Components: 1 disk, backup, teacher's guide, Stellar 28 board game. The game and program may be purchased separately.
Features: Protected
Producer: Hubbard Scientific
Vendor: Hubbard Scientific
Cost: $44.95

Title: *Computer Star Finder*

Copyright: 1985
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: NR
Minimum System Requirements:
Apple II family, 48K
IBM PC family, 64K

Description:

Computer Star Finder contains a database of stars, constellations and planets. Users may locate constellations and stars according to year, month, day, hour, and minute for the years 1900-2100 AD. Planet positions are plotted for 1984-1990. Entire sky views or enlarged views can be plotted. If the combination pack is purchased, a Season Star Chart Book is included. Here, charts of the sky (2 per season) are printed in four luminous colors for identification of visible stars. Includes general information on the stars.
Components: 1 disk, backup, Season Star Chart Book; the program or the book may be purchased separately.
Features: Protected, lab pack, site licensing and networking available
Producer: Hubbard Scientific
Vendor: Hubbard Scientific
Cost: $44.95

Title: *Course Master - Begin.Astronomy*

Copyright: 1986
Subject: Astronomy
Application: Earth Science, Physics
Type: Drill and Practice
Grade Level: 7 - 9
Minimum System Requirements:
Apple II family, 48K
Commodore 64/128
IBM PC, 64K, Basic

Description:

Course Master - Begin.Astronomy is a drill and practice program consisting of 8 multiple choice quizzes on astronomy totaling 154 items. The user can elect which quiz to take and is given the option of answering by number or by a typed answer. The typed answer must be spelled correctly. Each correct answer is rewarded with a brief graphic. The user is informed of the correct answer for items missed. The missed items reappear repeatedly until they are answered correctly. The quiz is concluded with a reward graphic and a summary of the score. The following are quizzes included with the program: Moon, Planets, Sun, Universe, Space Flight, Sun & Climate, Latitude & Longitude, and Atmosphere. An edit feature permits changing or adding quiz items. Disk space is available for the user to create an additional 22 quizzes of up to 30 items each.
Components: 1 disk, backup available, user's guide
Features: Copy protected, site license available, lab pack available
Producer: COMPU-TATIONS
Vendor: COMPU-TATIONS
Cost: $29.95

Title: *The Daily Planet*

Copyright: 1985
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: 7 - 12
Minimum System Requirements:
Apple II family, 64K
IBM, 64K, Basic, color graphics card

Description:

The Daily Planet is an astronomical almanac program that provides location data for the planets, Sun, and Moon. The program offers a variety of data options tied into the user's longitude and latitude and the date. Any date can be chosen between the years 1000 and 9999. Six options are available from the main menu permitting the user to see data about planets, the Sun, and Moon. After a particular option is chosen, right ascension and declination data is displayed and a second menu permits the selection of additional data such as phase, distance in astronomical units, and rising and setting times. Other options permit the display of a chart showing the positions of the planets as seen from Earth and an interval program that charts the movement of a single object for a selected number of days into the future. The teacher-student guide included with the disk contains 16 tutorial activities that explain the meaning of the data and various astronomical concepts involving planetary motion. The activities require data searches with the program.
Components: 1 disk, backup, teacher-student's guide
Features: Copy protected; after loading, the disk can be removed from the drive
Producer: School Management Arts, Inc.
Vendor: School Management Arts, Inc.
Cost: $69.95

Title: *The Earth and Moon Simulator*

Copyright: 1986
Subject: Astronomy
Application: Earth Science
Type: Simulation
Grade Level: 5 - 12
Minimum System Requirements:
Apple II family, 48K

Description:

The Earth and Moon Simulator provides animated simulations of the orbital relationships of Earth and Moon. Nine different simulations and one quiz demonstrate the relative paths of Earth and Moon, lunar phases, Earth tides, sidereal and synodic months, total solar and lunar eclipses, and an Earth horizon view of the Moon over an interval of several days. The lunar phase simulation, as an example, shows the relative positions of the Sun, Earth, and Moon. Animation moves the Moon in its orbit while a window view shows the Moon, as seen from Earth, progressing through its phases. All simulations feature the option of continuous motion or step motion. Some simulations permit switching on lines that indicate shadows or alignments. Each simulation is prefaced with a text display explaining what is being demonstrated.
Components: 1 disk, backup, teacher's guide
Features: Copy protected, lab packs available, network version available
Producer: Focus Media Incorporated
Vendor: Focus Media Incorporated
Cost: $99.00

Title: *The Earth Through Time and Space*: *The Earth Science Series*

Copyright: 1986
Subject: Astronomy, Manned Space Exploration
Application: Earth Science
Type: Tutorial
Grade Level: 5 - 9
Minimum System Requirements:
Apple II family, 48K,
IBM PC Jr, 128K

Description:

The Earth Through Time and Space: *The Earth Science Series* contains three programs. The first is a geological history of the Earth containing colorful graphics that illustrate different concepts. Emphasis is placed on the Great Ice Ages. Animated sequences demonstrate lunar and solar eclipses, the Moon's phases, and the effect of the Moon on the Earth's tides. The last two lessons present the planets, their orbits, and their characteristics. Students operate a probe through the solar systems identifying the various bodies.
Components: 1 disk, backup, management system records student scores, user's manual, reproducible activity masters
Features: Protected, lab pack available
Producer: Educational Activities
Vendor: Educational Activities
Cost: $59.95

Title: *Eclipse Master*

Copyright: 1986
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: NR
Minimum System Requirements:
IBM PC family, 256K
Commodore 64/128
Apple II family, 64K

Description:

Eclipse Master computes solar and lunar eclipses within an accuracy of 1 mile for central line 1/20 at 1% magnitude. The software is accurate to 3" of arc in longitude and 1" in latitude. Other calculations include central line, local circumstances, area of visibility, duration, and width of central line. In addition, the eclipse season may be found for any year.
Components: 1 disk, user makes own backup, user's manual
Features: Not protected, lab pack, site licensing and networking available
Producer: Zephyr Services
Vendor: Zephyr Services
Cost: $29.95

Title: *Eclipses and Phases of the Sun and Moon*

Copyright: 1985
Subject: Astronomy
Application: Earth Science, Geometry
Type: Tutorial
Grade Level: 9 - A
Minimum System Requirements:
Apple II family, 64K

Description:

Eclipses and Phases of the Sun and Moon is a text and diagram tutorial program on solar and lunar eclipses and lunar phases. The causes and differences between total, partial, and annular solar eclipses and umbral and penumbral lunar eclipses are demonstrated. Space view diagrams of the Sun, Earth, and Moon illustrate how eclipses and lunar phases are produced. A 12-question test on the content of the program is automatically administered but can be accessed directly from the menu if desired.

This program is one of four parts in an astronomy computer program series and is available individually or with the rest of the series. Other Titles in the series: *The Solar System, Time and Seasons*, and *Telescopes* .
Components: 1 disk, backup
Features: Copy protected, multiple backups may be available
Producer: Educational Images Ltd.
Vendor: Educational Images Ltd.
Cost: $33.75

Title: *Experiments - Exploring the Solar System*

Copyright: 1984
Subject: Astronomy, Manned Space Exploration
Application: Earth Science
Type: Game
Grade Level: 6 - 9
Minimum System Requirements:
Apple II family, 48K

Description:

Experiments - Exploring the Solar System provides students with a game designed to teach facts about the planets and stars. Students gather data based on worksheets and information presented in the program. Then students construct a space ship, select supplies, and accumulate energy which is consumed during travel to the planets, time lapsed, and incorrect answers.
Components: 1 disk, teacher's guide, worksheet masters
Features: Protected
Producer: SRA
Vendor: SRA
Cost: $105.00

Title: *Floppy Almanac*

Copyright: Public Domain
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: 9 - A
Minimum System Requirements:
IBM PC/AT/XT, 256K, MS-DOS

Description:

Floppy Almanac is an annual publication of the U.S. Naval Observatory. It reproduces the major sections of several annual publications, including the *Astronomical Almanac, Air Almanac,* and *Nautical Almanac* in computer format. With equal precision with the printed version, the program provides the user with extensive time and coordinate data for the Sun, Moon, planets, stars, Messier objects, and compact extragalactic radio sources. Additional file options include sidereal times, catalog definition (for stars and deep space objects), rise, set, and transit times, navigation information, and daily configuration (concise summary of most frequently used information). Data accessible in the program extends for a 400-day period equivalent to one calendar year plus an approximate two week overlap at each end. New floppy almanacs are issued for each year.
Components: 1 disk, user's guide
Features: Not protected, user makes own backup, Co-processor and mainframe versions available
Producer: U.S. Naval Observatory
Vendor: U.S. Naval Observatory
Cost: $20.00

Title: *Halley's Comet on Your Home Computer*

Copyright: 1985
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: 9 - 1
Minimum System Requirements:
Apple II family, 48K
Commodore 64/128
IBM PC, 64K, color graphics card
TI Pro, 64K, color graphics card

Description:

Halley's Comet on Your Home Computer is a two-part program providing information about Halley's Comet in history leading up to its 1986 perihelion with the Sun and information about how to locate the comet in the sky. Various choices from a menu permit the user to display an orbital plot of Halley's Comet for any year after the year 1000. The comet finder choice locates the comet against a background of stars for the 1910 and 1986 passages. A "Worldwide Skyplot" identifies where to look for the comet for any geographic location and date.
Components: 1 disk, user makes own backup, teacher's guide, user's guide
Features: Not protected
Producer: S&T Software Service
Vendor: S&T Software Service
Cost: $49.95

Title: *Indoor Astronomy*

Copyright: 1986
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: NR
Minimum System Requirements:
Apple II family, 64K
IBM, 256K, DOS 2.0, color graphics card
Commodore 64K, color graphics card

Description:

Indoor Astronomy is a star and deep space object mapping program including nearly 6,000 naked eye stars and 2,000 deep-sky objects. The user enters right ascension and declination coordinate data for the desired portion of the sky and a star field appears on the monitor. Visual magnitudes of stars from -2 to 6.0 are indicated with coded symbols. Positions of deep space objects such as galaxies, nebulae, and star clusters can be displayed. The user is permitted to magnify the field of view and shift its position. In the cursor mode, the user may move the cursor to any desired object and its coordinates will appear in a text window. The user may add and save new objects on the map such as the appearance of a comet and plot its daily positions over a period of time.
Components: 1 disk, user makes own backup, user's guide
Features: Not protected
Producer: Astro Link
Vendor: Astro Link
Cost: $59.00

Title: *Interplanetary Travel*

Copyright: 1986
Subject: Astronomy
Application: Earth Science
Type: Tutorial
Grade Level: 6 - 12
Minimum System Requirement
Apple II family, 64K
IBM PC Jr, DOS 2.0 or 2.1, 128K
Tandy 1000, Tandy DOS

Description:

Interplanetary Travel is a tutorial program that makes extensive use of color graphics and animations to investigate the solar system. The user takes a voyage to various planets to gather data about them and to compare them to each other. A data base providing many bits of information about each planet is available including distance from the Sun, rotation, revolution, escape velocity, number of moons, and orbital velocity. On occasion, the user is asked to formulate possible conclusions from the data presented such as relating the carbon dioxide levels in the atmosphere of Venus and its surface temperature. A glossary can be accessed to explain the meanings of new vocabulary words encountered. At the completion of the program a ten-question quiz is given to evaluate the user's understanding of the concepts presented. A record-keeping function for the teacher permits the storage of test scores for 100 students.
Components: 2 disks, backups, teacher's guide
Features: Copy protected, lab packs available, record keeping
Producer: Prentice-Hall Courseware
Vendor: Prentice-Hall Allyn & Bacon
Cost: $69.00

Title: *Introduction To The Hubble Space Telescope*

Copyright: Public Domain
Subject: Astronomy
Application: Earth Science
Type: Tutorial
Grade Level: 5 - 8
Minimum System Requirements:
Apple II family, 48K

Description:

Introduction To The Hubble Space Telescope is a tutorial program which uses text and graphics to explain the structure, advantages, and capabilities of NASA's Hubble Space Telescope, planned for launch in 1989. The menu offers programs on the construction, instruments and applications, imaging, and communications of the telescope. Detailed diagrams support the text.
Components: 1 disk, HST supplementary information (available from NASA Teacher Resource Centers on request)
Features: Program may be copied freely, will support networking
Producer: NASA Aerospace Education Services
Project/NASA Goddard Space Flight Center
Vendor: NASA Teacher Resource Centers*
Cost: Free
Introduction To The Hubble Space Telescope and related information will become available through the CompuServe computer information service by entering "GO Space" at any prompt. Watch for an announcement alerting CompuServe users of its availablility.
*Contact the NASA Teacher Resource Center that serves your state for details.

Title: *Knowledge Master - Astronomy*

Copyright: 1984
Subject: Astronomy, Manned Space Exploration
Application: Earth Science
Type: Drill and Practice
Grade Level: 7 - 12
Minimum System Requirements:
Apple II family, 48K

Description:

Knowledge Master - Astronomy is a quiz program containing 400 questions on astronomy and space exploration. The quiz may be taken singly or by two users in competition. Any of the following quiz topics may be chosen at random from a menu: Astronomy History, Stars and Planets, Moon, Sun, Eclipses, Universe, Astronomical Theories, Gravity, Stellar Spectroscopy, Space Exploration. Answers to questions may be letter choices or typed answers. For typed answers, the program requires exact wording and spelling but asks, following the display of the correct answer, if the user got it right. In the competition mode, two users play against each other. A question is displayed and the first player to tap an assigned key gets to answer the question verbally. The second player may try to give a better answer verbally and then the program displays the correct answer. The two players then decide who got the question correct and enter the credit through the keyboard. At the end of the competition the program selects the winner. An optional utility disk available from the producer enables editing of questions.
Components: 1 disk, user's guide, replacement disks available
Features: Copy protected
Producer: Academic Hallmarks
Vendor: Academic Hallmarks
Cost: $27.00

Title: *Life Cycles of Stars*

Copyright: 1986
Subject: Astronomy
Application: Earth Science
Type: Tutorial
Grade Level: 6 - 12
Minimum System Requirements:
Apple II family, 64K
IBM PC Jr, DOS 2.0 or 2.1, 128K
Tandy 1000, Tandy DOS

Description:

Life Cycles of Stars makes extensive use of color graphics and animations to investigate the properties of different stars, to classify stars, and to examine their evolution. Stars are compared for size, apparent and absolute magnitude, luminosity, and temperature. The relationship between star temperature and color is demonstrated. The different kinds of stars such as white dwarfs and red giants are described and placed on the H-R diagram. The processes that lead to supernovas and black holes are graphically represented. When desired, a glossary can be accessed to explain the meanings of new vocabulary words encountered. At the completion of the program a ten-question quiz is given to evaluate the user's understanding of the concepts presented. A record keeping function for the teacher permits the storage of test scores for 100 students.

Components: 2 disks, backups, teacher's guide
Features: Copy protected lab packs available, record keeping
Producer: Prentice-Hall Courseware
Vendor: Prentice-Hall Allyn & Bacon
Cost: $69.00

Title: *Lost In The Universe*

Copyright: Public Domain
Subject: Astronomy
Application: Earth Science
Type: Game
Grade Level: NR
Minimum System Requirements:
Apple II family, 48K

Description:

Lost In The Universe is an astronomical guessing game. The user's pet "Star Dog" has run away from home in a spaceship to one of 15 distant astronomical locations. The user must locate the dog within 400 seconds by reading various clues about the location. Clues include the location's temperature, distance from Earth, diameter, colors, position in the sky in relation to background constellations, composition, and graphical representation. Each clue selected deducts a certain number of seconds from the time available for the search. The object of the game is to find the dog in the least number of seconds possible.

Components: 1 disk, user makes own backup
Features: Not protected
Producer: Houston Museum of Natural Science
Vendor: NASA Teacher Resource Centers*
Cost: Free
*Contact the NASA Teacher Resource Center that serves your state for details.

Title: *MacStronomy*

Copyright: 1987
Subject: Astronomy
Application: Astronomy, General Science
Type: Utility
Grade Level: NR
Minimum System Requirements:
Apple Macintosh, 128K (requires either extended disk, double side capability or hard drive)

Description:

MacStronomy is an observational astronomy program displaying three windows. The sky window provides maps of the sky as it appears from any latitude and longitude on Earth at any time. These maps may be printed and objects in the sky may be identified. The planet window provides maps of the planet in relation to the sun. The description window provides short descriptions of objects. The data base is expandable.
Components: 1 disk, text converter, user makes own backup, user's guide, special rates for bulk purchases, optional larger data base $15.00
Features: Not protected
Producer: Etlon Software
Vendor: Etlon Software
Cost: $75.00

Title: *Mickey's Space Adventure*

Copyright: 1984
Subject: Astronomy
Application: Earth Science, Science Fiction
Type: Game/Tutorial
Grade Level: 3 - 6
Minimum System Requirements:
Apple II family, 64K
IBM PC, PC jr, 128K
Commodore 64

Description:

Mickey's Space Adventure introduces the planets, their order in the solar system, their characteristics, and the concepts of gravity, rotation, and revolution. The detailed teacher's manual provides a short story to be read to students before working with the software. This story provides the background information necessary to set up the game. Students help Mickey and Pluto obtain information by exploring the characteristics of the solar system, mapping, and keeping watch of such things as oxygen supply.
Components: 2 double-sided disks, backups, teacher's manual, reproducible activity sheets, comic book, poster
Features: Protected
Producer: Disney
Vendor: Disney
Cost: $59.00

Title: *Mind Games - Space*

Copyright: 1985
Subject: Astronomy, Manned Space Exploration
Application: Earth Science
Type: Game
Grade Level: 5 to 8
Minimum System Requirements:
Apple II family, 48K
IBM PC, PCJr, 128K, Basic, color graphics card

Description:

Mind Games - Space is a trivia style question game that one to four persons can play. Each person is assigned a token that moves around a game board appearing on the monitor. Each player's turn begins with a random die roll on the computer and the token is automatically moved the corresponding number of spaces on the board. A question from one of four categories (Shuttle, Careers, Astro-terms, Space Travel) appears requiring a multiple choice or a yes or no answer. A correct answer is reinforced with additional information and points are awarded to the player. Missed questions are given to other players in rotation to answer for lesser point values. When one player reaches a total number of points agreed upon by all the players at the beginning of the game, the player is declared the winner. Games taking too long to complete during one session can be stored and resumed at a later time. A question bank contains 142 questions. A write and edit function permits adding additional questions.
Components: 1 disk, permission is granted to make 2 backup disks, instruction booklet
Features: Not protected, site licensing available, network version available
Producer: Diversified Educational Enterprises, Inc.
Vendor: Diversified Educational Enterprises, Inc.
Cost: $39.95

Title: *Moontracker*

Copyright: 1986
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: NR
Minimum System Requirements:
IBM PC family 256K
Apple II family 64K
Commodore 64/128

Description:

Moontracker calculates the circumstances for a lunar eclipse and displays the areas of visibility on a world map, including penumbral and umbral phases, and the rise/set lines. Tabular data is also generated including fraction coverage of the Moon's diameter by penumbra and umbra, position angle of shadow, longitude and latitude of point directly under the moon, degrees separating the Earth and Moon shadows, angular radius of the penumbra and umbra, and angular diameter of the moon.
Components: 1 disk, user makes own backup, user's manual
Features: Not protected, lab pack, site licensing and networking available
Producer: Zephyr Services
Vendor: Zephyr Services
Cost: $29.95

Title: *Nitemapper*

Copyright: 1986
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: NR
Minimum System Requirements:
IBM PC family, 256K
Commodore 64/128
Apple II family, 64K

Description:

Nitemapper presents the user with an on-screen world map showing day areas in white, night areas in gray and flashing symbols where the Sun and Moon are directly overhead. These are calculated for any date and time. In addition, the other information displayed is the equator, Moon rise/set line and the ecliptic, lunar nodes, and perigee point projected onto the surface.
Components: 1 disk, user makes own backup, user's manual
Features: Not protected, lab pack, site licensing and networking available
Producer: Zephyr Services
Vendor: Zephyr Services
Cost: $29.95

Title: *Our Atmosphere - The Science Professor Unit 5*

Copyright: 1986
Subject: Astronomy
Application: Earth Science
Type: Tutorial
Grade Level: 4 - 6
Minimum System Requirements:
Apple II family, 48K

Description:

Our Atmosphere - The Science Professor Unit 5 describes the facts regarding the Earth's atmosphere. Included topics are clouds, atmospheric layers, mass, gravity, and environmental concerns. Students answer questions at various points during the program and complete an examination while playing the "Torpedo Game" at the end of the program. Incorrect answers are pointed out along with the correct response. These may be printed for future study.
Components: 1 disk, worksheet and answer sheet
Features: Protected, can purchase unprotected programs at $78.00, lab pack, site licensing and district license available
Producer: Bergwall Educational Software
Vendor: Bergwall Educational Software
Cost: $39.95

Title: *Our Moon*

Copyright: 1987
Subject: Astronomy
Application: Earth Science, General Science
Type: Tutorial
Grade Level: 2 - 6
Minimum System Requirements:
Apple II family, 48K

Description:

Our Moon presents elementary students with basic concepts about the moon. Students are presented with factual material and then are intermittently asked multiple choice questions. If answers are incorrect a review is presented and the student tries again. At the end of the program students are presented with a quiz.
Components: 2 disks, teacher's guide, backups
Features: Protected, lab pack available
Producer: January Productions
Vendor: January Productions
Cost: $35.00

Title: *Our Solar System*

Copyright: 1987
Subject: Astronomy
Application: Earth Science, General Science
Type: Tutorial
Grade Level: 2 - 6
Minimum System Requirements
Apple II family, 48K

Description:

Our Solar System presents elementary students with basic concepts about our solar system. Students are presented with factual material and then are intermittently asked multiple choice questions. If answers are incorrect a review is presented and the student tries again. At the end of the program, students are presented with a quiz.
Components: 2 disks, teacher's guide, backups
Features: Protected, lab pack available
Producer: January Productions
Vendor: January Productions
Cost: $35.00

Title: *Our Solar System*

Copyright: 1988
Subject: Astronomy
Application: Earth Science
Type: Tutorial
Grade Level: 5 - 7
Minimum System Requirements:
Apple II family, 48K

Description:

Our Solar System introduces the solar system to students at the 5th through 7th grade levels. The program conducts a comparative study of each planet as it relates to the Sun, Earth, and other planets. Information presented in the tutorial includes size, distance, temperatures, orbits, and other factors as they relate to the planets in the solar system. Vocabulary, review, final tests, and a teacher management system are elements of this program.
Components: 1 disk, backup disk available, 1-page teacher's guide with vocabulary
Features: Protected, lab pack available
Producer: Little Shaver Software
Vendor: Little Shaver Software
Cost: $29.95

Title: *Our Sun*

Copyright: 1983
Subject: Astronomy
Application: Earth Science
Type: Tutorial
Grade Level: 4 - 7
Minimum System Requirements:
Apple II family, 48K

Description:

Our Sun features information on the Sun as the star in our solar system. The program contains a two-part tutorial, vocabulary game and a final test. Students must correctly answer questions found in the tutorial to continue, reviews are provided. A teacher management system is contained in the program.
Components: 1 disk, backup disk available, 1-page teacher's guide with vocabulary
Features: Protected, lab pack available
Producer: Little Shaver Software
Vendor: Little Shaver Software
Cost: $29.95

Title: *Our Sun*

Copyright: 1987
Subject: Astronomy
Application: Earth Science, General Science
Type: Tutorial
Grade Level: 2 - 6
Minimum System Requirements: Apple II family, 48K

Description:

Our Sun presents elementary students with basic concepts about the sun. Students are presented with factual material and then are intermittently asked multiple choice questions. If answers are incorrect a review is presented and the student tries again. At the end of the program students are presented with a quiz.
Components: 2 disks, teacher's guide, backups
Features: Protected, lab pack available
Producer: January Productions
Vendor: January Productions
Cost: $35.00

Title: *PC Planetarium*

Copyright: 1986
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: NR
Minimum System Requirements: IBM PC family, 128K, double-sided disk drive, medium resolution graphics capability, dot-matrix printer

Description:

PC Planetarium draws sky maps from any point on Earth at any time. The stars are of magnitude 4.5 and brighter. They include our Sun, the Moon, Halley's Comet, and the planets to Saturn. With one key stroke, any object may be identified and local coordinates calculated. High resolution sky maps may be printed. The right ascension and declination of any object may be specified. The accuracy of calculations is limited to 5 or 6 significant figures.
Components: 1 disk, user makes own backup, hand-documented Basic Source Code listing available, demo disk available
Features: Not protected, uncompiled Basic Source Code
Producer: Light Software
Vendor: Light Software
Cost: $52.00

Title: *Planet Hopping - The Science Professor Unit 7*

Copyright: 1986
Subject: Astronomy
Application: Earth Science
Type: Tutorial
Grade Level: 4 - 6
Minimum System Requirements:
Apple II family, 48K
Commodore 64

Description:

Planet Hopping - The Science Professor Unit 7 is the seventh unit in a total of ten in the "Science Professor" series. The program takes the user on a Space Shuttle trip through the solar system. Planets from Mercury through Saturn are visited individually and a few facts about each one are presented. Uranus, Neptune, and Pluto are visited as a group and the asteroid belt also is visited. Periodically, a brief stop is made for a question requiring an answer from the user. Between planetary stops, single facts about the solar system or the Sun appear on the screen. Graphics and an occasional animation illustrate each stop. At the completion of the trip the user is invited to play the "Torpedo Game." Matching answers for nine questions are displayed across the middle of the screen. Torpedos are launched that eliminate each choice when correctly chosen. At the end of the game a 10th question is asked and the game is scored. Incorrectly answered questions are displayed again with correct answers. If desired, a printout of the missed questions can be made.

Components: 1 disk, backup available, teacher's guide.
Features: Copy protected, unprotected version available, site and district license agreement available
Producer: Bergwall Educational Software, Inc. also published by Dynacomp
Vendor: Bergwall Educational Software, Inc.
Cost: $39.00

Title: *Planetarium on Computer: Your Solar System*

Copyright: 1984
Subject: Astronomy
Application: Earth Science
Type: Simulation
Grade Level: 5 - 12
Minimum System Requirements:
Apple II family, 48K

Description:

Planetarium on Computer: Your Solar System offers three programs relating to the planets. The first simulates the orbital motion of the planets around the Sun as seen from an oblique view out in space. Only three or four of the nine planets appear at a time on the simulation in order to keep relative distances in scale. The user is able to pull back from the solar system to see the outer planets or move closer to see the inner planets. The planets in each view are animated, and as they orbit the Sun, the passage of years for each planet is indicated. A quiz activity asks the user the names of the planets based on their relative orbital positions. The second program asks the user's weight on Earth and then calculates what the user would weigh on any planet the user chooses. A quiz activity

Title: *Planetarium on Computer: Your Solar System (continued)*

gives the user's weight on an unknown planet and asks the user to identify what that planet is. The third program takes the user's Earth age and demonstrates, through animation, the equivalent age on other planets. A quiz activity gives the user's equivalent age from an unknown planet and asks the user to identify the planet.
Components: 1 disk, backup, teacher's guide
Features: Copy protected, lab packs available, network version available
Producer: Focus Media Incorporated
Vendor: Focus Media Incorporated
Cost: $69.00

Title: *Planetary Construction Set*

Copyright: 1985
Subject: Astronomy
Application: Earth Science, Biology
Type: Simulation
Grade Level: 8 - A
Minimum System Requirements: Apple II family, 48K

Description:

Planetary Construction Set combines planetary science, biology, and physics in a simulation of extraterrestrial life and environments. In the "Cadet's Mission" the user is challenged to design a planet by choosing the kind of central star it orbits, its mass, distance, composition, atmosphere, inclination, and presence of satellites. Following all selections, a planet is created to the user's specifications. A variety of calculations, such as the length of year, length of day, and surface temperature are displayed. To prepare the user to make decisions, briefings provide background information such as a tutorial with quizzes on measurement, and details about stellar evolution, star types, and information about our solar system.

After mastering the planetary construction process, the user is briefed on the "Captain's Mission" in which alien life forms are encountered in various galaxies. The aliens' home planets have become uninhabitable and the Captain must design a new planet suitable for them. The successful creation of a suitable new planet requires note taking and experimentation. After a planet is created, the program evaluates its suitability and identifies conditions that need to be changed. The user then experiments with various environmental changes until the planet becomes suitable.
Components: 1 disk, backup, teacher's guide
Features: Copy protected, lab pack available, Corvus network version available, district purchase plan
Producer: Sunburst Communications Inc.
Vendor: Sunburst Communications Inc.
Cost: $59.00

Title: *The Planetary Guide*

Copyright: 1981
Subject: Astronomy
Application: Earth Science
Type: Tutorial
Grade Level: 9 - A
Minimum System Requirements:
Apple II family, 64K

Description:

The Planetary Guide is a text and diagram encyclopedic program on the planets and other objects in our solar system. Five topics offer the user an opportunity to examine basic information about each planet, compare diameters and orbits, and view orbital motions. One of the topics discusses the Sun, planet moons, asteroids, and comets. Simple animations demonstrate the relative orbital motions of the planets and retrograde motion. An ephemeris-style option places the planets in their approximate correct positions to each other as viewed from outside the solar system or against background constellations as seen from Earth for any date from the year 1 to the year 1999.
Components: 1 disk, backup, user's guide
Features: Copy protection, multiple backups may be available
Producer: Educational Images Ltd.
Vendor: Educational Images Ltd.
Cost: $49.95

Title: *Planetary Motion*

Copyright: 1983
Subject: Astronomy, Aerospace Physics
Application: Earth Science, Physics
Type: Tutorial
Grade Level: NR
Minimum System Requirements:
Apple II family, 48K

Description:

Planetary Motion teaches basic facts of planetary astronomy and emphasizes general concepts in physics. The goal of the program is to present students with the elementary ideas of astronomy, simple relationships between variables, and Newton's Law of Gravitation and its application. The teacher's manual provides suggestions on the use of the product, and the package contains student worksheets designed to supplement the concepts presented in the software.
Components: 1 disk, teacher's guide, copyable student worksheets, backup available
Features: Protected, lab pack, site licensing, and networking available
Producer: Albion
Vendor: Queue
Cost: $39.95

Title: *The Planets*

Copyright: 1987
Subject: Astronomy
Application: Earth Science, General Science
Type: Tutorial
Grade Level: 2 - 6
Minimum System Requirements:
Apple II family, 48K

Description:

The Planets presents elementary students with basic concepts about the planets. Students are presented with factual information and then are intermittently asked multiple choice questions. If answers are incorrect a review is presented and the student tries again. At the end of the program students are presented with a quiz.
Components: 2 disks, teacher's guide, backups
Features: Protected, lab pack available
Producer: January Productions
Vendor: January Productions
Cost: $35.00

Title: *Skies Above - The Water Below*

Copyright: 1985
Subject: Astronomy
Application: Earth Science, Physical Science
Type: Tutorial
Grade Level: NR
Minimum System Requirements: Apple II family, 48K

Description:

Skies Above - The Water Below is a 4-disk series containing physical facts of the solar system and the water systems on the Earth. The Planets disk covers physical information on each planet and students review this information on a "simulated" journey. The Stars disk covers the development of stars from birth to destruction. Students identify constellations. The Streams and Rivers disk reviews physical information on the flow of water on the Earth's surface. The Oceans disk covers life forms and geological features. Teacher management is included.
Components: 4 disk set, backup available
Features: Protected, networking version available, lab pack available
Producer: Aquarius People Materials, Inc.
Vendor: Aquarius People Materials, Inc.
Cost: $115.00

Title: *The Sky*

Copyright: 1986
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: 7 - A
Minimum System Requirements: IBM PC, 512K, color graphics card

Description:

The Sky is a star map program. Following the entering of the user's coordinates and desired local time, an approximate 100 degree slice of the sky appears. The slice is tapered near the top to minimize distortion of the star field. By pressing the right or left arrow keys, the field can be scrolled to view the sky in any desired compass direction. The up arrow brings up a circular display of the overhead sky. Recalculations of star and object positions are continually made and the positions are replotted in real time to match the changes taking place to the actual sky due to Earth's rotation. An identifier function permits moving an arrow to any unknown object to learn its identity and coordinates. If desired, any portion of the sky can be zoomed in on and magnified and seen as though looked at by a wide field telescope. Positions of the planets, Messier objects and nonstellar objects such as galaxies are displayed. Stars and any other object on the screen can be toggled off for faster recalculations. During position recalculation, the time increment can be changed permitting an acceleration of planets and viewing of star trails. Data bases are available showing which stars, planets, Messier objects, and nonstellar objects are visible for the selected date and time. Diagrams can be brought up showing a space view of the inner planets, outer planets, or entire solar system.
Components: 1 disk, user's guide, user makes own backup
Features: Not protected, site licenses available, lab packs available, network version available
Producer: Computer Assist Services
Vendor: Computer Assist Services
Cost: $60.00

Title: *Sky Lab*

Copyright: 1985
Subject: Astronomy
Application: Earth Science
Type: Tutorial
Grade Level: 7 - 9
Minimum System Requirements:
Apple II family, 64K

Description:

Sky Lab permits users to compare the "backyard" view of the motions in the sky with a "spaceview." Demonstrated with graphics and animation are the rotating Earth, revolving Earth, revolving planets, and the movements of Halley's Comet during its 1986 passage of the Sun. The effects on the position of the Sun in the sky by Earth's rotation is shown with graphic views from a backyard looking to the east, south, and west. The user can move from direction to direction to view the sky at different times of the day. The revolution section shows the movement of Earth around the Sun and the apparent movement of the constellations of the Zodiac at different times of the day and seasons. Revolution of Mars and Venus, as representatives of the inferior and superior planets, demonstrate the positional relationship between Earth and each planet during revolution. Each demonstration is followed by a discovery activity permitting the user to review graphic and animation screens at random and compare backyard and spaceviews of particular positions. A check quiz follows the discovery activity and scores are retained in a records keeping file. Demonstrations, discovery activities, and quizzes are accessible at random from a menu.
Components: 1 disk, backup available, user's manual
Features: Copy protected, lab packs available, Corvus network version available
Producer: MECC
Vendor: MECC
Cost: $49.00

Title: *The Solar System*

Copyright: 1985
Subject: Astronomy
Application: Earth Science
Type: Tutorial
Grade Level: 9 - A
Minimum System Requirements:
Apple II family, 64K and
Commodore 64

Description:

The Solar System is a text and diagram tutorial program on the objects that make up our solar system. The program is divided into topics on the Sun, planets, moons, asteroids and meteors, comets, and a multiple choice self-test of 42 questions covering all areas. Details of the Sun's composition, structure, history and future are covered. Information about each of the planets except Earth is presented as well as general and specific details about moons, asteroids, meteors, and comets. This program is one of four parts in an astronomy computer program series and is available individually or with the rest of the series. Other titles in the series: *Eclipses of the Sun and Moon, Time and Seasons, Telescopes* .
Components: 1 disk, backup
Features: Copy protection, multiple backups may be available
Producer: Educational Images Ltd. Also published by Dynacomp
Vendor: Educational Images Ltd.
Cost: $33.75

Title: *The Solar System*

Copyright: 1986
Subject: Astronomy
Application: General Science
Type: Tutorial
Grade Level: 1 - 2
Minimum System Requirements:
Apple II family, 48K
Commodore 64/128

Description:

The Solar System is an introduction to the solar system for the young student. In a tutorial format, information is presented to the student and then the student is asked true/false questions covering the content. A "game" review follows where the student attempts to build a rocket by answering ten questions correctly.
Components: 1 disk, teacher's guide, reproducible worksheets, replacement of disk available
Features: Protected
Producer: Right On Programs
Vendor: Right On Programs
Cost: $25.00

Title: *The Solar System - The Science Professor Unit 6*

Copyright: 1986
Subject: Astronomy
Application: Earth Science
Type: Tutorial
Grade Level: 4 - 6
Minimum System Requirements:
Apple II family, 48K

Description:

The Solar System - The Science Professor Unit 6 is the sixth unit in a total of ten in the "Science Professor" series. It is written so that it can stand alone and is available for separate purchase or as part of the complete series. The program provides a basic introduction to the solar system. A mnemonic device to help the user remember the name of the planets in order is presented and various concepts such as orbit, rotation, year, and day, and the causes of Earth's seasons are defined and discussed in simple form. Periodically, test questions requiring an answer from the user appear. Graphics and an occasional animation are employed to illustrate concepts. At the completion of the trip the user is invited to play the "Torpedo Game." Matching answers for nine questions are displayed across the middle of the screen. Torpedos are launched that eliminate each choice when correctly chosen. At the end of the game a 10th question is asked and the game is scored. Incorrectly answered questions are displayed again with correct answers. If desired, a printout of the missed questions can be made.
Components: 1 disk, backup, teacher's guide
Features: Copy protected, unprotected version available, site and district license agreement available
Producer: Bergwall Educational Software, Inc.
Vendor: Bergwall Educational Software, Inc.
Cost: $39.00

Title: *Solar System Astronomy*

Copyright: 1984
Subject: Astronomy
Application: Earth Science
Type: Tutorial
Grade Level: 9 - A
Minimum System Requirements:
IBM PC, 64K, color graphics card, DOS 1.1+
Apple II family, 48K
Commodore 64

Description:

Solar System Astronomy provides a tutorial experience on information about our solar system. The menu features six file choices including inner planets, outer planets, comets, greenhouse effect, history of the solar system, and life in the solar system. The inner planet file, as an example, provides facts about Mercury, Venus, Earth, Moon, and Mars. Each planet is graphically illustrated and orbits of each planet are demonstrated with animation. The comet file illustrates comet structure and orbits. Life in the solar system discusses the definition of life and the planetary conditions necessary for living things to survive.
Components: 1 disk, teacher's guide, user makes own backup
Features: Copy protected, lab packs and site licenses available
Producer: Cross Educational Software
Vendor: Cross Educational Software
Cost: $30.00

Title: *SOLARSIM — The Solar System Simulation Program*

Copyright: 1985
Subject: Astronomy
Application: Earth Science
Type: Simulation
Grade Level: 7 - A
Minimum System Requirements:
IBM PC/XT/AT, 128K, PC-DOS, color graphics card
Zenith Z-100, 192K, Z-DOS or MS-DOS, 3-plane graphics adapter
TI PRO, 256K, MS-DOS, 3-plane graphics adapter

Description:

SOLARSIM — The Solar System Simulation Program is a star and planet atlas program featuring star and planet maps and animation simulating planetary motions as viewed from space, from Earth or any planet, or even from Halley's Comet. The "Solar" program offers many options including the number of planets to be displayed, constellations outlined, and the length of time the simulation will run. Over 250 asteroids and comet alternates are also available for orbital motion simulation. The "Skyscene" program shows the position of the visible planets and stars (over 800 stars are available for display) in any horizon direction or overhead towards the zenith. Options include displaying the ecliptic and right ascension and declination lines. Constellations may or may not be outlined as chosen by the user. An identification option in either program permits moving a small square to an unknown object. The object will be identified by name as a planet, star including its constellation, moon, or Halley's Comet. Data coordinates of objects are displayed and tables of planetary information are available when desired.
Components: 1 disk, user makes own backup, user's guide
Features: Not copy protected
Producer: Interstel Corp.
Vendor: Interstel Corp.
Cost: $29.95

Title: *Space-Understanding Our Solar System: Science #4*

Copyright: 1986
Subject: Astronomy, Manned Space Exploration
Application: Earth Science
Type: Tutorial
Grade Level: 4 - 6
Minimum System Requirements:
Apple II family, 64K
IBM PC family, 128K

Description:

Space-Understanding Our Solar System: Science #4 provides the student with basic space concepts that may be explored through the two programs contained in this package: Space Data Base and Flight Simulation. Topics included in Space Data Base are Mapping in Space, Small Objects in Space, The Planets, The Solar System, Galaxies, and Deep Space. New data bases may be constructed. Students choose from four simulations in the second program, Flight Simulation. After making the necessary preparations, students embark on a journey, steering the space craft and identifying objects on the screen.
Components: 1 disk, copyable class record sheet and individual student progress charts, teacher's guide, backup available, user's guide with lesson packs for teachers
Features: Protected, lab pack available
Producer: The Ellen Nelson Learning Library
Vendor: Decision Development Corporation
Cost: $49.95

Title: *Star Cal 3*

Copyright: 1986
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: NR
Minimum System Requirements:
IBM PC, 128K, PC-DOS or MS-DOS 2.0 or higher, high resolution graphics screen

Description:

Star Cal 3 is an astronomical events calendar, clock, and star chart. The calendar program informs the user of coming events on a monthly basis for any month from 1984 through 1990. Covered events include phases of the Moon, lunar and solar eclipses with terrestrial locations for viewing them, oppositions of Mars, Jupiter and Saturn, east and west greatest elongations of Venus, culminations of 85 constellations, meteor showers with expected hourly rate, and miscellaneous events including the opposition of the asteroid Vesta. After data is displayed for any particular month, the user may examine any other month available in the program. The clock program uses the computer's internal clock to keep hour and minute times in six standards including local standard time, daylight time, local civil time, local mean sidereal time, universal, and Greenwich mean sidereal time. Function keys are used to shift quickly from one standard to another. The Star Chart Generator produces a chart of 500 stars (4th magnitude and brighter) and planets for any time ranging from 15,000 B.C. to 15,000 AD. The stars are positioned in a circular display with the overhead point in the center of the screen. Relative magnitudes of the stars are represented with larger or smaller dots. The star chart is displayed according to the observer's latitude. The user may select which compass direction should appear at the bottom of the screen to make comparison to the actual sky easier.
Components: 1 disk, user makes own backups, user's guide
Features: Not protected
Producer: Software City. Also published by Dynacomp
Vendor: Software City
Cost: $29.95

Title: *The Star Gazer's Guide*

Copyright: 1980
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: 9 - A
Minimum System Requirements:
Apple II family, 64K

Description:

The Star Gazer's Guide is a guidebook program for the location and identification of northern hemisphere constellations. Star charts for winter and summer stars are available and are displayed on the monitor. When desired, identification numbers from a master list of 40 appear alongside their respective constellations. Geometric outlines also can be displayed. The user is able to call up magnified views of any constellation from the master list. Symbols indicating double stars, clusters, nebulae, and galaxies visible with little or no magnification and within the vicinity of the called up constellation are indicated. Data displays for each constellation are available as well as background information about galaxies and other objects.
Components: 1 disk, backup, multiple backups may be available, user's guide
Features: Copy protection
Producer: Educational Images Ltd.
Vendor: Educational Images Ltd.
Cost: $49.95

Title: *Starchart*

Copyright: 1984
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: 9 - A
Minimum System Requirements:
Apple II family, 64K
IBM PC, PC-AT, PC-XT, or compatible, 128K, PC-DOS 2.1 + or MS-DOS, color graphics card

Description:

Starchart is a variable date star and deep space object atlas. The user is asked for celestial sphere coordinates of right ascension and declination and the program calculates the positions of the various stars and objects located in the appropriate area of the sky and displays them on the screen. Up to 15 symbols will appear in a window indicating star positions of visual magnitudes ranging from 6.00 to -1.99, globular and open clusters, planetary and diffuse nebulae, galaxies, and celestial poles. If desired, the sky can be searched by selecting a particular constellation or Messier object. Once the star field is displayed, the user can move to adjacent areas of the sky with keyboard commands. Increases or decreases in the window scale showing a wider or a more narrow view of the sky is also possible. When an unfamiliar object is encountered, a cursor can be moved to the object and the program will identify it. Lists of stars and deep space objects with their coordinates are available for display on the window or for printout. With a printer interface card capable of performing bit image mapping, any graphics screen can be printed out.
Components: 2 disks, user makes own backup, user's manual
Features: Not protected
Producer: Visionary Software
Vendor: Visionary Software
Cost: $39.95

Title: *Stargazer*

Copyright: 1987
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: 6 - A
Minimum System Requirements:
Macintosh, 128K

Description:

Stargazer is an astronomical map program featuring right ascension and declination data for over 1200 stars in both the northern and southern hemisphere. The program is begun when the user first selects the month, day, time of day, and the geographic longitude and latitude from which the sky will be viewed. The night sky is generated for the chosen coordinates. The field of view of the sky displayed is approximately 90 degrees vertically and 150 degrees horizontally on the screen. Apparent visual magnitudes of individual stars are symbolized by dots of different sizes. An identification function permits moving the arrow to a particular star and it will be identified along with its coordinates. If desired, the constellation the star belongs to will be given. A "Sky Show" option runs through each visible constellation on the screen by rapidly flashing member stars while the constellation name is displayed below. A printed negative copy of the displayed sky can be made.
Components: 1 disk, user's manual, user makes own backup
Features: Not protected
Producer: Mousetrap Software
Vendor: Mousetrap Software
Cost: $24.94

Title: *Stargazing*

Copyright: 1985
Subject: Astronomy
Application: Earth Science, Physics
Type: Tutorial
Grade Level: NR
Minimum System Requirements:
Apple II family, 64K

Description:

Stargazing helps students identify constellations and other celestial patterns. Stargazing begins by offering the students three sets of options: season of the year, degree of difficulty, and whether the stars are to be viewed from the city or country. The program displays a series of constellations and the student enters the name of the constellation or one of its stars. The program checks for accuracy (including spelling). Additional hints are given if the student makes an error.
Components: 1 disk, backup, information card
Features: Protected, lab pack available
Producer: Conduit
Vendor: Conduit
Cost: $60.00

Title: *Stellar Astronomy*

Copyright: 1981
Subject: Astronomy, Philosophy
Application: Earth Science
Type: Tutorial
Grade Level: 6 - A
Minimum System Requirements:
Apple II family, 48K
IBM PC, 64K, DOS 1.1+, color graphics card
Commodore 64

Description:

Stellar Astronomy is a program concentrating on stars, galaxies, and scientific and philosophical cosmology. Individual files explain the H-R diagram, types of stars, constellations, doppler effect, death of stars, and galaxies. Graphics are used to illustrate most files. The doppler effect file uses animation and mathematics to demonstrate the increase or decrease of sound wave frequency with moving emitters or receivers. Quizzes are employed in some files to check comprehension. The philosophic cosmology file contains extensive discussions on a variety of theories, including Genesis 1, Deism, Nihilism, Astrology, Pantheism, and Polytheism, for the creation of the universe and the position humans occupy in it.
Components: 1 disk (two sides), user's/teacher's guide, user makes own backup
Features: Not protected, lab packs and site license available
Producer: Cross Educational Software
Vendor: Cross Educational Software
Cost: $30.00

Title: *Suntracker*

Copyright: 1986
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: NR
Minimum System Requirements:
IBM PC family, 256K
Commodore 64/128
Apple II family, 64K

Description:

Suntracker calculates astronomical conditions for any solar eclipse and displays a map of areas of visibility. The program also computes and provides eclipse elements accurate to 12 miles on the Earth's surface. The user may input elements to achieve greater accuracy. The central line of the eclipse is plotted on a world map and the limits of visibility for a partial eclipse are also plotted. The user can specify the percent of coverage of the Sun's diameter for the partial eclipse. Tabular data for the eclipse includes central line location, width, duration of totality and the altitude of the Sun.
Components: 1 disk, user makes backup, user's manual
Features: Not protected, lab pack, site licensing and networking available
Producer: Zephyr Services
Vendor: Zephyr Services
Cost: $29.95

Title: *Tellstar - Level II*

Copyright: 1985
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: NR
Minimum System Requirements:
Macintosh, 512K,
Apple II family, 64K
IBM, 128K

Description:

Tellstar - Level II provides astronomical maps of stars, planets, and Messier objects for the northern and southern hemispheres. The user enters the time and date, longitude and latitude, and chooses northern or southern hemisphere and whether or not solar objects will be displayed only, or whether or not Messier objects will be displayed. The program calculates positions of stars and celestial objects and displays them in an overhead view or a horizon view in the direction of the user's choice. A data screen to the left displays coordinate information, calendar date, Julian date, and local, mean, sidereal, and Universal Time. An identifier function, using the cursor, tells what the object or star is and provides coordinate and visual magnitude data. A locater function operates in the opposite manner by flashing the cursor in the appropriate location when the name of an object is entered. Special utilities assist in conversion of coordinates from one system to another and calculation of precession from the 1950 epoch. The utilities also provide coordinate data and rising and setting times for solar system objects. If desired, printed copies can be made of any map and data table.
Components: 1 disk, user's guide, user makes own backup
Features: Not protected
Producer: Scharf Software Systems, Inc.
Vendor: Spectrum Holobyte, Inc.
Cost: $79.95

Title: *Time and Seasons*

Copyright: 1985
Subject: Astronomy
Application: Earth Science
Type: Tutorial
Grade Level: 9 - A
Minimum System Requirements:
Apple II family, 64K

Description:

Time and Seasons is a text and diagram tutorial program on how time is determined and on the causes of Earth's seasons. The two topics are handled separately and are followed with 12 and 13-question tests. The program on seasons explains inclination and parallelism of Earth's axis and how these two factors combine with Earth's rotation to vary the directness of the Sun's rays and length of daylight leading to seasonal changes. The time program discusses Earth rotation, meridians, time zones, daylight saving time, and the international dateline. This program is one of four parts in an astronomy computer program series and is available individually or with the rest of the series. Other titles in the series: *Eclipses of the Sun and Moon, The Solar System, Telescopes*
Components: 1 disk, backup
Features: Copy protection, multiple backups may be available
Producer: Educational Images Ltd.
Vendor: Educational Images Ltd.
Cost: $33.75

Title: *Time and Seasons*

Copyright: 1987
Subject: Astronomy
Application: Earth Science
Type: Tutorial
Grade Level: 6 - 9
Minimum System Requirements:
Apple II family, 48K
Atari 400, 800, 1200

Description:

Time and Seasons graphically presents meridians, time zones, rotation, seasons, and length of day and year. Material is presented to students and review questions follow. In the section called "World Farmer" students raise crops on two sides of the equator over an 18-month period. This exercise includes planting, cultivating, and harvesting. The "Inter-National Phone Call" section presents the problems encountered with date and time changes.
Components: 1 disk, teacher's guide, worksheets, student workbook, tests
Features: Protected
Producer: Rand McNally
Vendor: Rand McNally
Cost: $111.00

Title: *Travelling Through the Solar System*

Copyright: 1985
Subject: Astronomy
Application: Earth Science
Type: Tutorial
Grade Level: 3 - 6
Minimum System Requirements:
Apple II family, 48K

Description:

Travelling Through the Solar System simulates forty-two possible missions to planets and moon in our solar system. To determine their mission students are presented with facts and clues (regarding temperature, gravity, location, atmosphere, orbit and rotation) of the Sun, planets and moons. Students deduce from the facts and clues which planets their mission calls for them to visit.
Components: 1 disk, teacher's guide, worksheets
Features: Protected
Producer: D.C. Heath
Vendor: D.C. Heath
Cost: $60.00

Title: *Twilight*

Copyright: None
Subject: Astronomy
Application: Physical Science
Type: Utility
Grade Level: 5 - A
Minimum System Requirements:
IBM PC, 64 K, Basic A
Atari, 32K

Description:

Twilight calculates the time of sunrise, azimuth of sunrise, time of sunset, azimuth of sunset, and the maximum altitude of the Sun. To run the program, the user must enter the year and month for which calculations are required and the west longitude, north latitude, and time zone of the observer. Data for the complete month appears and times are given in standard time. If desired, calculations may be printed out.
Components: 1 disk, user makes own backup, user's information sheet
Features: Not protected, will support networking
Producer: Tech-Link Incorporated
Vendor: Tech-Link Incorporated
Cost: $14.00

Title: *Wonders of the Solar System*

Copyright: 1987
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: 6 - A
Minimum System Requirements:
Apple II family, 48K

Description:

Wonders of the Solar System includes a database of facts about celestial bodies in our solar system. Students are encouraged to compare planets, moons, comets, and asteroids. Students may then classify them by size, orbital radius, and other categories. Students may add solar bodies to the second disk to maintain accurate and complete information about the solar system.
Components: 2 disks, user's guide, copyable fact sheets
Features: Protected, lab pack, and site licensing available
Producer: Program Design International
Vendor: Queue
Cost: $59.95

Title: *Your Universe - The Solar System*

Copyright: 1985
Subject: Astronomy
Application: Earth Science
Type: Tutorial
Grade Level: 4 - 8
Minimum System Requirements:
Apple II family, 48K

Description:

Your Universe - The Solar System is a quiz program covering the nine planets, moons, Sun, asteroids, gravity, and motion. After the user selects a variety of options including the number of questions to be used in the quiz from 1-20, whether there are 1 or 2 players, and whether or not a game is to be included, the first quiz question appears. A correct response moves the program to a game where the user tries to earn extra points by landing a spaceship on the Moon. If the game is not used, a score and the next question appears. If the user is uncertain of an answer or makes an incorrect response, an offer of extra help is made in the form of 26 tutorial screens that provide background information relating to the questions. The user may "turn pages" with arrow keys and read all of the screens in turn or return to questions when desired. *Your Universe - The Solar System* is one of three programs in a single package. The other programs are *The Earth* and *Your Weather.*
Components: 3 disks, backups, teacher's guide
Features: Copy protected, lab packs available, network version available
Producer: Focus Media Incorporated
Vendor: Focus Media Incorporated
Cost: $99.00

Manned Space Exploration

Title: *Earth Orbit Stations*

Copyright: 1987
Subject: Manned Space Exploration
Application: Earth Science, Economics
Type: Game, Simulation
Grade Level: NR
Minimum System Requirements:
Apple II family, 64K (will not run on Apple II GS)
Commodore 64/128

Description:

Earth Orbit Stations allows players to choose from seven game scenarios in which players build and manage space stations in the search for alien life. The game scenarios may last from two to forty hours offering players complex strategic situations with multiple choices and opportunities for decision making. Up to four players are allowed.
Components: 2 disks, user's manual
Features: Protected
Producer: Electronic Arts
Vendor: Electronic Arts
Cost: Apple $34.95, Commodore 64/128 $29.95

Title: *The Earth Through Time and Space: The Earth Science Series*

(See Astronomy.)

Title: *Experiments - Exploring the Solar System*

(See Astronomy)

Title: *Galactic Prospector*

Copyright: 1984
Subject: Manned Space Exploration
Application: Earth Science, Social Studies
Type: Game
Grade Level: 7 - A
Minimum System Requirements:
Apple II family, 64K

Description:

Galactic Prospector sets students the goal of finding, and returning four energy resources to a space colony. Players encounter problems—limited fuel with which to search for the energy sources, and an enemy agent who tries to steal the resources. Exploration for the resource involves a progression of analysis that includes photography, air magnetometry, mapping, seismic testing, gravity, test drilling, weather data, water analyses, airborne radiometry, ground radiometry, and core drilling.
Components: 1 disk, backup, user's manual, progress report form
Features: Protected
Producer: Disney (Epcot Educational Media)
Vendor: Disney
Cost: $59.00

Title: *The Halley Project - A Mission in Our Solar System*

Copyright: 1985
Subject: Manned Space Exploration
Application: Earth Science
Type: Simulation
Grade Level: 5 -12
Minimum System Requirements:
Apple II family, 64K
Commodore 64/128, joystick required
Atari, joystick required
Amiga, 512K

Description:

The Halley Project - A Mission in Our Solar System begins with a "secret" message on a cassette tape that invites the user to try out as a spaceship pilot for the "Halley Project." The user is given ten increasingly difficult missions throughout the solar system. All missions begin at a secret base on the nucleus of Halley's Comet. At the start of each mission, the user is given an assignment in cryptic form such as "Your first destination is any planet with no atmosphere." Clues encourage research on the solar system. The user must identify the correct planet or moon and then locate its direction on a radar screen. The circumference of the screen shows the location of 12 constellations and by adjusting the screen, the distance to the destination is estimated. The user next scans the actual constellations through the control panel view screen and steers the spacecraft in the proper direction. Two power settings permit a full range of velocity control up to "Hyperspace" which exceeds the speed of light.

After presenting an image of the destination, an information screen identifies the object and its distance. At first, the object appears as a star-like image that moves within the background of stars. As the user approaches, the object's image expands to fill the screen. Phases with the Sun are depicted as well as eclipses with any moons present. The object of the mission is to safely land on the destination body. Once landed, the user sees a horizon panorama and is given the next destination. The destination may be to return to the comet or to another body described by a cryptic clue. The most difficult missions require six different destinations. At the completion of each mission, the time consumed is recorded in a data base.
Components: 1 disk, backup, teacher and user's guide, audio cassette
Features: Protected, lab pack available, site license available
Producer: Tom Snyder Productions
Vendor: Mindscape School Software
Cost: $49.95

Title: *History of Space Flight*

Copyright: 1985
Subject: Manned Space Exploration
Application: Earth Science
Type: Tutorial
Grade Level: NR
Minimum System Requirements:
Apple II family, 64K
IBM PC family, 64K

Description:

History of Space Flight provides students with hundreds of multiple choice questions on the history of flight. The program maintains a running score after each question and when a student opts to quit, the incorrect answers are displayed.
Components: 1 disk, backup available, supplementary readings
Features: Protected, networking available, lab pack, and site licensing available
Producer: Sliwa Enterprises, Inc.
Vendor: Queue
Cost: $39.95

Title: *Knowledge Master - Astronomy*

(See Astronomy.)

Title: *Lunar Explorer*

Copyright: 1986
Subject: Manned Space Exploration
Application: Earth Science, Physical Science
Type: Simulation
Grade Level: NR
Minimum System Requirements:
Apple II family, 48K
IBM, 128K, DOS 2.0, color graphics card

Description:

Lunar Explorer simulates the flight of a lunar landing vehicle over the surface of the Moon. The user takes on the role of the pilot by using keyboard or joystick controls. Through a variety of training exercises, the user becomes proficient in takeoffs and landings, hovering, and navigation. Flying the lander requires fueling, engine arming and firing, thrust control, and control of pitch and roll motions. For navigation a window and radar screen provide a horizon view of the lunar terrain and a downward radar view. Pitch and roll motions of the lander change the window view. Depending upon the maneuver, the entire window is filled with the lunar surface or with a starry sky and Earth. Altitude, vertical and horizontal velocity, distance from the lunar base, pitch and roll angles, fuel consumption, and engine thrust are displayed along the bottom of the screen. When the pilot is proficient with the controls, a game involving the retrieval of lunar ore containers can be played.
Components: 1 disk, user's guide with suggestions for classroom use, backup copy available
Features: Protected
Producer: Electric Transit
Vendor: Spectrum Holobyte
Cost: $29.95

Title: *Mind Games - Space*

(See Astronomy.)

Title: *Orbital Mech*

Copyright: 1986
Subject: Aerospace Physics, Manned Space Exploration
Application: Physical Science
Type: Simulation
Grade Level: NR
Minimum System Requirements:
Macintosh, 512K

Description:

Orbital Mech simulates the motion of a Space Shuttle in orbit above Earth. The user maneuvers the orbiter by changing its attitude and by firing reaction control engines. The mouse or keyboard is used for maneuvering. At the beginning of the simulation a number of options are available including adding a second attracting body and increasing or decreasing their masses and distances. These changes alter the gravitational field the orbiter operates within. The user is given the opportunity to experiment with different kinds of orbits such as stable orbits found at certain geometric points in relation to the Earth and Moon and with transfer orbits. Other options include "Trail" which marks the path of the shuttle as it orbits and "Station" which places a space station in orbit. With the station option the object of the simulation is to maneuver the orbiter for rendezvous and

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Title: *Orbital Mech (continued)*

docking. When a close approach is accomplished, the screen magnifies for a close-up view of the final docking. Velocity and attitude errors can result in collisions causing the orbiter to tumble away. During simulations, status windows at the bottom of the screen indicate relative velocity, position, time, and fuel consumption. When desired, any screen can be printed.

Components: 1 disk, user makes own backup, user's manual
Features: Not protected
Producer: Studio Zero, Inc.
Vendor: Studio Zero, Inc
Cost: $34.95

Title: *Orbiter*

Copyright: 1986
Subject: Manned Space Exploration, Rocketry
Application: Earth Science, Physical Science
Type: Simulation
Grade Level: NR
Minimum System Requirements:
Macintosh, 512K,
IBM PC, 256K, two 360K drives, DOS 2.0, color graphics card

Description:

Orbiter places the user in the commander's seat of a Space Shuttle orbiter during simulated missions. The user commands the orbiter during liftoff, orbital operations, and reentry and landing. Missions include satellite deployment, satellite repair, and space rendezvous. Assisting the commander is a control panel divided into four quadrants. Each represents a different area of the fore and aft flight deck control panels. Depending upon the task at hand, any of seven areas of the fore control panel, five areas on the aft control panel, and six CRT status screens can be activated along with a view out the windows to the front of the orbiter or into the cargo bay. The layout of the controls simulates the controls of an actual shuttle orbiter.

A typical mission begins with a prelaunch countdown. Instructions from Mission Control are "radioed" through the computer's synthetic voice as well as appearing on one of the CRT screens. Instructions require replies and control actions such as activating power systems. The commander, with the guidance of mission control, proceeds through a countdown and lifts off. CRT screens can be activated by the commander to display flight parameters in numerical and graph form. Upon reaching orbit, the commander is instructed to open the payload bay doors and proceed with the mission which may include using the remote manipulator system arm to deploy the payload. Aft controls work the arm to move it about to release the payload or capture another to bring it into the bay. When needed, a crew member can travel from the payload bay with a manned maneuvering unit to approach a satellite. Random equipment malfunctions can occur requiring action on the part of the commander. At the conclusion of the mission, the orbiter must be positioned for reentry and controlled through landing.

Components: 1 disk (2 disks IBM), user makes own backup, user's guide
Features: Not protected
Producer: Spectrum Holobyte, Inc.
Vendor: Spectrum Holobyte, Inc.
Cost: $49.95

Title: *Project Space Station*

Copyright: 1985
Subject: Manned Space Exploration
Application: Earth Science, Physical Science, Economics
Type: Simulation
Grade Level: 7 - Adult
Minimum System Requirements:
Apple II family, 64K
IBM PC, DOS 3.0, 256K, color graphics card
Commodore 64

Description:

Project Space Station simulates the start to finish process of planning, constructing, and operating an orbital space station. A new mission starts with planning that begins with the budget and goes through crew selection, equipment and module acquisitions, station design, and launch scheduling. Funds must be allocated to each item from a total budget of $10 billion. Tutorial, help, and data files are available for assistance. When a crew is selected, as an example, biographies of candidates are available. Before starting the mission, choices are evaluated and those not approved must be replanned. Poor planning or inattention to details such as timelines can lead to emergencies.

Two space shuttles are employed to boost equipment and crew to orbit. The user participates in the automatic launch by steering the vehicle towards a launch window permitting rendezvous at the station site. At the completion of each phase, the user switches icons to tasks such as EVA in which crew members maneuver payloads and modules to dock with the station. The user must be conscious of time and return orbiters to Earth before life support expendables are exhausted. Random problems may alter carefully laid plans. During the landing sequence, the user takes over control of the orbiter and lands on the runway. Poor landings require down time for vehicle repair. Current positions in the simulation can be stored and restarted later.

Components: 1 disk, user's manual
Features: Protected (IBM version unprotected and permits networking), lab packs may be available
Producer: HesWare
Vendor: Odyssey Magazine
Cost: $34.95, ($29.95 for Commodore version).

Title: *Space Data Bases*

Copyright: 1987
Subject: Manned Space Exploration
Application: Earth Science
Type: Utility
Grade Level: 5 - A
Minimum System Requirements:
Must be used with Bank Street School Filer
Apple II family, 64K
Commodore 64/128

Description:

Space Data Bases contains database files on manned space missions, space probes, and a time line file of important events in the history of space exploration. The package is designed to be used with Bank Street School Filer. Six database files are contained on the disk: Time line, Missions, Launches, Books, Glossary, and Survey. Survey is a student-created database used to analyze the results of a class survey about space exploration and space predictions.

Components: 1 disk, backup, teacher's guide
Features: Copyable database disk, lab pack available
Producer: Sunburst
Vendor: Sunburst
Cost: $59.00

Title: *Space M+A+X*

Copyright: 1986
Subject: Manned Space Exploration
Application: Physical Science, Social Studies, Economics, Project Management
Type: Simulation
Grade Level: 9 - A
Minimum System Requirements: IBM PC, PC-AT, PC-XT, 192K, IBM PC-DOS 2.1+, color graphics card, PS/2 models 25 & 30

Description:

Space M+A+X is a space station construction simulation. The user, playing the role of project manager, enters all phases of the station development from budget, schedule, logistic planning, and mission launches to orbital operations. The object is to assemble and operate the station according to schedule, within budget, and generate a profit from orbital operations.

A simulation is begun by checking budget plans detailing everything from space station module costs to crew orbital costs. A construction plan is formulated and launch vehicles are loaded with space station components and crew. Components include command, habitation, solar array, heat radiator, adapters, experiment, pallet, and space factory modules. Payload weights as well as costs must be considered. Four shuttle orbiters can be employed as well as unmanned heavy lift vehicles. Once on orbit, station modules are positioned with arrow keys, assembled, and tested for integrity. The assembly plan is determined by the project manager and profits from the station are calculated, in part, by the functional nature of the design. Until the station becomes operational, one shuttle orbiter must remain on orbit to provide life support for crew. Accidents and malfunctions cause delays.

The program features many graphic screens diagramming project budgets, flight manifests, vehicle launches and returns, and the space station as it is assembled. Five levels of difficulty are available for the simulation. Music can be toggled on or off. Station assembly progress can be saved for later resumption.

Components: 3 disks, 137-page user's manual, replacement disks available
Features: Protected, and copyable versions available, lab packs available
Producer: Final Frontier Software
Vendor: Final Frontier Software
Cost: $49.95/$59.95

Title: *Space Shuttle Clip Art*

Copyright: 1988 (Public Domain)
Subject: Manned Space Exploration
Application: Earth Science
Type: Database
Grade Level: K - A
Minimum System Requirements:
Macintosh 800K disk drive

Description:

Space Shuttle Clip Art is a graphics database containing over fifty line drawings and scanned images of the Space Shuttle and its components. The images contained in the program are stored in the PICT format version and a Macpaint format version and can be accessed and manipulated by a number of Macintosh graphic drawing programs. Possible activities are described in the teacher's guide. The teacher's guide contains hard copies of all the images in the data base, including a shuttle glider kit.
Components: 1 disk, teacher's guide
Features: Not protected
Producer: Department of Aviation and Space Education, Oklahoma State University for the NASA Office of Educational Technology, Educational Affairs Division
Vendor: NASA Teacher Resource Centers*
Cost: Free
*Contact the NASA Teacher Resource Center that serves your state.

Title: *Tranquility Base*

Copyright: 1984
Subject: Manned Space Exploration
Application: Earth Science
Type: Game
Grade Level: 6 - 12
Minimum System Requirements:
Apple II family, 48K
IBM PC family

Description:

Tranquility Base is a game/simulation in which players launch, maneuver, orbit, and land a spacecraft on the moon. Data is provided to players on the "command module console" as well as a view. Players manipulate thrust, race, pitch, and may select from one of three starting situations.
Components: 1 disk, user's manual
Features: Protected
Producer: EduWare
Vendor: EduWare
Cost: $39.95

Rocketry

Title: *Aeronautics Disc*

(See Aeronautics.)

Title: *Aerodynamics of Model Rockets*

(See Aeronautics.)

Title: *ASTROCAD: Performance Analysis for Model Rockets*

Copyright: 1987
Subject: Rocketry, Aeronautics
Application: Earth Science, Physical Science
Type: Utility
Grade Level: NR
Minimum System Requirements: Apple II family, 64K

Description:

ASTROCAD: Performance Analysis for Model Rockets is a series of eleven programs that is intended for experienced model rocketeers to predict the effects of design changes and evaluate the probable performance of various designs. Included in the menu selection are: Apogee Determination, Stability Determination, Dynamic Stability, Drag Prediction, Drag Estimation, Performance Prediction, Optimum Weight, Flight Simulation, Elliptical Fin Design, Model Rocketry Design Stored Data, and Model Rocketry Design Input Version. A hard copy of the programs may be printed to increase user understanding of the concepts involved.
Components: 1 disk, user makes own backup, user's guide
Features: Not protected
Producer: Estes Industries
Vendor: Estes Industries
Cost: $19.95

Title: *Exploring Tables and Graphs*

Copyright: 1984
Subject: Rocketry
Application: Mathematics, Earth Science
Type: Tutorial
Grade Level: 5 - 6
Minimum System Requirements: Apple II family, 64K

Description:

Exploring Tables and Graphs is primarily a graphing program that allows students to input data and the resultant graph appears on screen and may be printed. Along with features one might expect, an introduction to picture, bar, and area graphs, this software contains applications that feature such topics as animals, satellites, football stars, and more.
Components: 1 disk, user's manual, backup available
Features: Protected, lab pack available
Producer: Optimum Resource, Inc.
Vendor: Optimum Resource, Inc.
Cost: $39.95

Title: *In Search of Space — Introduction To Model Rocketry*

Copyright: 1986
Subject: Rocketry
Application: Earth Science, Physical Science
Type: Tutorial
Grade Level: 4 - 12
Minimum System Requirements: Apple II family, 64K

Description:

In Search of Space — Introduction To Model Rocketry is a series of seven programs that introduces the topic of model rocketry. Parts and functions of a typical model rocket, prelaunch preparations, and flight profile are explained through text and illustrated with diagrams. Model rocket engine design and classification is explained. Four of the eight programs are followed with three to five question tests. The program on the model rocketry safety code is followed by a 25 question review test. A score of 80% or better on this test is rewarded with unlocking a hidden eighth program on two-stage rockets that is not accessible from the menu.
Components: 1 disk, user makes own backup, user's guide, teacher's guide, three posters available
Features: Not protected
Producer: Estes Industries
Vendor: Estes Industries
Cost: $24.95

Title: *The Physics of Model Rocketry*

Copyright: 1987
Subject: Rocketry, Aerospace Physics
Application: Physical Science, Physics
Type: Tutorial
Grade Level: 9 - A
Minimum System Requirements: Apple II family, 64K

Description:

The Physics of Model Rocketry discusses and illustrates with color graphics the physical laws of motion and the forces of gravity and drag that affect the flight of rockets. The concepts of action-reaction, momentum, inertia, and acceleration are discussed in detail as they pertain to the performance of model rockets. The mathematics for calculating G forces and burnout velocities are presented with step-by-step examples. Rocket staging and the principles behind satellite orbits are presented. Frequent breaks are made for brief check questions requiring user answers.
Components: 1 disk, user makes own backup, user's guide, teacher's guide available
Features: Not protected
Producer: Estes Industries
Vendor: Estes Industries
Cost: $24.95

Title: *Shuttle Designer*

Copyright: 1985
Subject: Rocketry
Application: Physical Science, Mathematics
Type: Tutorial, Simulation
Grade Level: 7 - 12
Minimum System Requirements:
Apple II family, 64K
Commodore 64

Description:

Shuttle Designer provides the user an opportunity to design and test-fly rockets. A tutorial section explains how solid and liquid propellant rockets function and the mathematics behind their operation and performance. Technical rocket terms such as specific impulse and propellant density are explained. Following the tutorial, the user, now part of a rocket development team, is given an assignment to design a new rocket prototype. Following data entry, in which the user selects a number of vehicle parameters including the vehicle's size, propellant weight, kind of propellant, and thrust, the design is reviewed by a "committee" and accepted or sent back for changes. Once accepted, the vehicle is test-flown using animation. If the test is unsuccessful, the user is assigned the task of redesigning the rocket for another test. Two unmanned rocket design problems are given to the user before receiving a more challenging assignment of redesigning the space shuttle for increased performance. An additional tutorial explains the added considerations that must be made in designing vehicles for astronauts.
Components: 1 disk, user makes own backup, user's manual
Features: Not protected
Producer: Simpletech
Vendor: Simpletech
Cost: $29.95

Satellites

Title: *Earth Satellites*

Copyright: 1986
Subject: Satellites
Application: Physical Science
Type: Utility
Grade Level: 7 - 12
Minimum System Requirements:
IBM PC, 640K, BASIC
Commodore 64/128
Amiga, 512K

Description:

Earth Satellites is a collection of satellite location programs. With input of orbital parameters such as inclination, period, eccentricity, and observer coordinates, the coordinates for when and where to look for satellites are calculated. Equatorial crossings, altitude and azimuth, and local civil time are determined for visual or radio observations of particular satellites. The "ASTROS" program simulates real time tracking of satellites.
Components: 1 disk, backup available, user's guide
Features: Not protected, will run on network
Producer: Science Software
Vendor: Science Software
Cost: $24.95

Title: *Orbit II*

Copyright: 1983
Subject: Satellites
Application: Physical Science
Type: Simulation
Grade Level: 9 - 12
Minimum System Requirements:
Apple II family, 48K

Description:

Orbit II simulates the orbit of satellites around Earth. The program consists of nine progressively difficult "Challenges" and two manual operation options. Each challenge relates to the launching of a satellite. A set of conditions are listed and the user estimates the proper launch speed, in kilometers per second, and the launch angle to achieve a prescribed orbit. A graphic display shows the Earth and satellite launch point and uses animation to move the satellite. A dot trace is left behind to illustrate the orbital shape and the effect any changes in velocity make on the orbit. While the satellite is moving, arrow keys can initiate the firing of thrusters to accelerate or decelerate the satellite.

Some of the challenges involve launching a satellite from a space station or simulating the orbit of actual satellites such as the Tracking Data and Relay Satellite. Assisting all decisions on orbital maneuvers is a data display at the bottom of the screen providing readouts of the satellite's heading, speed, and radius from the center of Earth.
Components: 1 disk, user's and teacher's manual
Features: Not protected, site license available
Producer: Vernier Software
Vendor: Vernier Software
Cost: $24.95

Title: *Sat Plot*

Copyright: None
Subject: Satellites
Application: Physical Science
Type: Utility
Grade Level: 9 - A
Minimum System Requirements:
IBM PC, 64K, Basic A, color graphics card
Atari, 32K, Basic

Description:

Sat Plot is a plotting program that illustrates the orbit of a satellite against the backdrop of a world map. The satellite plotted, STS-11, moves in real time across the map in ten second intervals. A complete orbit, producing a sine curve, takes the same time to plot as the real satellite does to complete one orbit of Earth. The program continues plotting the orbit as long as permitted and lays the line of the second orbit a short distance to the west of the first to account for Earth rotation. If the user wishes to do so, the orbital values of the satellite can be changed by editing program lines to plot the path of a different satellite and use the display as a guide for observing satellite passes.
Description: 1 disk, user makes own backup, user's information sheet
Features: Not protected, will support networking
Producer: Tech-Link Incorporated
Vendor: Tech-Link Incorporated
Cost: $19.00

Title: *Satellite Orbits - Newton*

Copyright: 1982
Subject: Satellites
Application: Aerospace Physics
Type: Simulation
Grade Level: 9 - A
Minimum System Requirements:
Apple II family, 48K

Description:

Satellite Orbits - Newton plots the orbital path of a satellite around Earth based on the user's input of height and speed in meters at the time of orbital injection. The satellite is injected parallel to Earth's surface. The user also determines the time period for the orbital plots in multiples of 100 seconds. Following data entry, a filled circle representing Earth appears on the screen and the satellite is plotted as single pixels for its different positions. A data display to the side identifies the interval and current height and speed. If desired, a data table can be retrieved for the particular orbital parameters in use at the moment. The table displays height and speed data for each time interval as well as the arc angle of the orbit from the injection point.
Components: 1 disk, user makes own backup, teacher's and student's guide
Features: Not protected, lab pack available
Producer: Edward Arnold Ltd
Vendor: Educulture
Cost: $45.00

Science Fiction

Title: *Adventures in Space*

Copyright: 1985
Subject: Science Fiction
Application: Language Arts
Type: Utility
Grade Level: 3 - 9
Minimum System Requirements:
Apple II family, 64K
Commodore 64
IBM PC, PC-XT, PCJr, 64K

Description:

Adventures in Space is a creative writing program that asks the user to fill in the blank spaces in a space adventure story. The story places the hero on a NASA spaceship for a trip to a distant planet in a distant galaxy. The user must make choices, enter names, explanations, adjectives, and details to fill out the story. The various choices lead to different outcomes. By the end of the activity, a manuscript for a six-chapter story is ready for printout. The story can be constructed from start to finish, stopped at the end of any chapter and restarted, or edited. The edit function permits the user to see how input fits the text. After the story is acceptable to the writer, it is printed. Special printer paper, stickers for illustrations, and a hard cover are included for binding the story.
Components: 1 disk, backup available, user's guide, book binding materials
Features: Copy protected, lab packs available
Producer: Woodbury Software
Vendor: Grolier Electronic Publishing, Inc.
Cost: $39.95

Title: *Starflight*

Copyright: 1986
Subject: Science Fiction, Manned Space Exploration
Application: Earth Science, Social Studies
Type: Game, Simulation
Grade Level: NR
Minimum System Requirements:
IBM PC family, 256K
Tandy 1000, 1200, 3000

Description:

Starflight permits players to function as a commander of a six-member crew on an interstellar spaceship. As the commander, players try to find colonizable worlds, gather minerals and ancient artifacts, and learn the secrets of alien races in a galaxy of 270 star systems and 800 planets.
Components: 2 disks, star map, user's manual, user makes own backups
Features: Not protected
Producer: Binary Systems
Vendor: Electronic Arts
Cost: $49.95

Title: *Star Search*

Copyright: 1983
Subject: Science Fiction
Application: Earth Science
Type: Game
Grade Level: 6 - A
Minimum System Requirements:
Apple II family, 48K

Description:

Star Search presents students with a game of exploration. Players are captains on ships in a fleet whose mission is to explore planets in a newly discovered solar system. Players must manage crew and supplies in order to complete the expedition and return safely to the base planet.
Components: 1 disk, backup, user's manual
Features: Protected, lab pack available
Producer: Earthware Computer Systems
Vendor: Softkat Distributors
Cost: $45.00

Section 2: Additional Aerospace Education Software

The following aerospace education software programs were not described for the bibliography. Brief references were provided by producers/vendors and are listed below. Contact the vendors, listed in Appendix A, for additional information.

Astronomy Keyword, Apple II family, Carolina Biological Supply Company.
Astroview, Apple II family, Commodore 64, Dynacomp.
Atari Planetarium, Atari XE or XL, Astronomical Society of the Pacific.
Clock, Commodore 64/128, SX-64, Stratus Software.
Halley's Comet Locator, IBM, Dynacomp.
Interstellar, Commodore 64, Interstellar.
Investigating Gravitational Force, IBM, IBM.
Journey To The Stars, IBM, COMPress.
Kepler, Atari, Tech-Link.
The Moon and Its Phases, Apple II family, SouthWest EdPsych Services, Inc.
The Observatory, Apple II family, Carolina Biological Supply Company.
Sky Travel, Commodore 64 or 128, Astronomical Society of the Pacific.
Star, Atari, Tech-link.
STARS.BAS, *STARS.DAT*, IBM, Astromedia Corp.
Star Base II, Commodore 64/128, SX-64, Stratus Software.
Space Base Star Atlas, Atari, Dynacomp.
Superstar, IBM, picoScience.
Timebase, Commodore 64/128, SX-64, Stratus Software.
World Clock, Apple II family, Career Aids, COMpress.

Section 3: Laser Video Discs

Introduction

Just as microcomputer use is growing rapidly in the schools, other advanced educational technologies are growing and providing expanded resources for educators. One of these new technologies, laser video discs, is discussed in the following section of this bibliography; and available video discs for aerospace education are listed.

Although reliable statistics documenting the availability of laser disc players in schools are not available, it is clear that both the interest in the technology and the availability of laser disc players and software are increasing. Nearly every journal dealing with educational technology has devoted issues or features to laser disc technology. At least one, the *T.H.E. Journal,* provides a monthly section dealing exclusively with optical disc technology. The importance of optical disc technology is indicated by the inclusion of this laser disc section in the NASA *Software for Aerospace Education: A Bibliography, Second Edition.* Because this field is relatively new, the following brief introduction to optical disc technology may be helpful.

Laser video discs represent one example of several optical disc formats. Generally, all optical data devices operate by encoding digital information on a reflective surface by engraving tiny pits in the surface of the disc. These pits can then be read using a low-power laser beam. There are a variety of optical data formats which employ different standards and provide different specific capabilities. These formats include CD-ROM (Compact Disc - Read Only Memory), CD-V (Compact Disc - Video), CD-I (Compact Disc - Interactive), CD-WORM (Compact Disc- Write Once, Read Many), and laser video discs. Discs listed in this bibliography are all laser video discs.

There are several fundamental advantages of optical data storage over other electronic media. These advantages include larger storage capacities, faster data access times, and high reliability. The large storage capacity of optical media makes it possible for the teacher to have thousands of video images or pages of text available on a single disc as a reference. It would be impractical to provide the teacher with access to such extensive resources using any other medium. The fast access time provided by optical media make the discs especially appropriate for interactive applications where it may be necessary to branch to many different locations on the disc in response to input by the user. Linear media, such as video tape, require too much time to access specific points in the video to be of use for applications requiring extensive branching. Finally, since there is no physical contact between the disc and the player read mechanism, the discs should last indefinitely, unlike videotape where a read head contacts the tape during recording or playback.

There is also one major disadvantage to optical media as compared to videotape. Current technology does not allow the user to record on the disc. The user purchases a disc from a publisher who has duplicated the disc from a specially prepared master disc. Disc mastering and replication is currently an expensive, time-consuming process which involves sophisticated techniques and equipment. Although efforts continue to develop an optical disc medium which does provide read/write capability, such a disc is not currently available at an affordable cost.

There are two basic types of laser video discs. The standard play disc is referred to as a CAV (Constant Angular Velocity) disc. A 12-inch CAV disc is capable of storing up to 54,000 video images per disc side or up to 30 minutes of motion video with two audio tracks per side. Most discs contain a combination of still frames and video segments. The user of a CAV disc has the capability of randomly accessing any of the frames on the disc and displaying the frame indefinitely. Access time to search for any frame is typically one to five seconds. The extended play disc is referred to as a CLV (Constant Linear Velocity) disc. The 12 inch CLV disc provides up to 60 minutes of motion video but individual frames cannot be accessed. CLV discs are usually used for movies intended to be played from beginning to end. All laser video discs in this bibliography are in CAV format.

CAV discs can be utilized in one of three different modes. These modes represent different levels of interaction regarding the user's interaction with the content of the disc. In the first mode, level one, the user has full control of the disc player and can randomly access disc frames or proceed through the disc sequentially; branching is controlled by the user. Levei two mode applications utilize a disc player which has a memory which can be programmed to play a specified sequence of images from the disc. The programmed sequence may be embedded on the video disc and read into the player's memory or it may be entered by the user from the controller keypad. In level three mode, the disc player is connected to a microcomputer. An interface device and cable is required to connect the computer to the disc player. The interface provides a channel through which the computer can signal the disc player to display specified disc frames, video clips, or perform special commands such as slow motion. There are several vendors of interfaces compatible with a variety of disc players and computers. A program running on the microcomputer controls the disc player based upon programmed instructions and input from the user. Some programs provide for sophisticated branching in response to user input. Programs may be developed by a publisher to be utilized in conjunction with a specific video disc, disc player and computer configuration, or the program can be written by the teacher using an authoring language. Level three mode applications can be especially powerful learning tools in education. The discs listed in this bibliography are generally used in level one mode but can, if run on a properly configured system, be utilized in a level three mode. In the case of the discs produced by Optical Data Corporation, computer software is provided which the teacher can utilize to create interactive programming.

Introduction *(continued)*

Video discs, like other optical media, offer tremendous potential for education. The advantages of random frame access, special effects, and huge storage capacity which video discs have over other media such as tape or slides can be especially important in educational settings. The discs listed in this bibliography are just a few of those being published for educational applications. Discs are also available in biology, physics, foreign languages, art, mathematics, and other subjects.

Editor's Note: Optical Data Corporation, the publisher of most of the available video discs for aerospace education, markets them and related materials in several different formats and packages. Several new video discs are scheduled for release in 1989. Educators interested in video discs from Optical Data Corp. are encouraged to contact the company for current availability and purchasing options. The National Air and Space Museum is currently producing a sixth disc in their series entitled *Lunar Disc.* The disc will include photography from the Ranger, Surveyor, lunar missions, and other subjects. The museum plans a Spring 1989 release date.

Laser Video Disc Descriptions

Laser video discs are arranged alphabetically by title.

Title: *Apollo 17*

Copyright: 1984
Subject: Aerospace
Application: Physical Science
Type: Utility
Grade Level: 7 - A
Minimum System Requirements:
CAV Laser Disc Player
Television or Video Monitor
Optional: Microcomputer, Laser Disc player interface, and software

Description:

Apollo 17 provides an extensive photographic and video record from NASA's visual archives of the final Apollo lunar mission. The disc was prepared with the consultation of NASA's Educational Technology Office. *Apollo 17* is organized to provide a visual chronology of the mission, from an introduction to the mission and crew, through launch and lunar operations, and on to return to Earth. Prelaunch and training activities are included. Also included is a graphic sequence which illustrates Saturn V staging and the mission profile. The NASA reference number is provided where appropriate to identify photographs, and information on ordering slides is included in the image directory. The optional *Space Science Living Textbook* includes a lesson in which selected images and video are utilized to document the mission.

Thirty images from Space Shuttle mission STS-9 are included on side two of the disc. STS-9 was the first Spacelab mission and various scenes of experimental activity onboard Spacelab are present.

Components: One double-sided CAV video disc, image directory, map of landing site with diagrams indicating exploration routes and sites where experiment packages were deployed.

Features: Information on ordering slides or prints is provided.

Producer: Optical Data Corporation

Vendor: Optical Data Corporation, Ztek, MECC

Cost: $40.00

Title: *Astronomy*

Copyright: 1986
Subject: Astronomy
Application: Earth Science
Type: Utility
Grade Level: 9 - A
Minimum System Requirements:
CAV Laser Disc Player
Television or Video Monitor
Optional: Microcomputer, Laser Disc player interface, and software

Description:

Astronomy consists of astronomy and related imagery from a variety of sources. Celestial imagery is from observatories including the California Institute of Technology, Lick, Lowell, U.S. Naval Observatory, National Aeronautics and Space Administration, and the Jet Propulsion Laboratory. In addition to the observation imagery, there are numerous graphics developed by the publisher which illustrate various scientific principles important to astronomy such as the electromagnetic spectrum, doppler effect, principles of telescopes, and the effects of light pollution. Also, photographs of important observatories and famous astronomers are available on the disc. The Astronomy disc has several video segments which illustrate principles of astronomy and physics such as orbital mechanics, fluid dynamics, and conservation of angular momentum. A substantial segment on planetary science is included with imagery of the planets from telescopes and probes, as well as images of Earth from Landsat and Nimbus satellites and the Space Shuttle. An extensive image directory is provided with descriptions of the disc contents.
Components: One double-sided CAV video disc, image directory
Features: Copyrighted by publisher
Producer: Optical Data Corporation
Vendor: Optical Data Corporation, Ztek
Cost: $400.00

Title: *Encounters*

Copyright: 1986
Subject: Aerospace
Application: Science
Type: Utility
Grade Level: K - A
Minimum System Requirements:
CAV Laser Disc Player
Television or Video Monitor
Optional: Microcomputer and Laser Disc player interface

Description:

Encounters is a two sided video disc featuring computer graphics, animation, and video clips which depict solar system exploration, imagery from the Uranus encounter by *Voyager* 2, and science activities from Skylab and the Space Shuttle. Side one is devoted to exploration of the Solar System. Included is a computer animation depicting the movement of Comet Halley and the probes *Giotto*, *Vega*, *Suisei*, and *Voyager* 2 as they travel through the solar system. There are also numerous images from the exploration of Uranus and its moons taken by *Voyager* 2. Tutorial information on comets is included. Side two consists of a variety of video clips, most of which depict physics principles demonstrated on several Skylab and Space Shuttle missions. The video clips include a segment on space stations, Skylab astronaut Owen Garriott demonstrating the principles of gyroscopic stability, fluid dynamics demonstrations, magnetic forces in zero-gravity, and demonstrations of the behavior of toys in space. *Encounters* concludes with a video of scenes from the Shuttle Challenger's space missions set to music and the narration of the poem "High Flight".
Encounters is one disc in the Space Science Series.
Components: One double-sided CAV video disc, image directory
Producer: Optical Data Corporation
Vendor: Optical Data Corporation, Ztek, MECC
Cost: $40.00

Title: *Greetings from Earth*

Copyright: 1985
Subject: Aerospace
Application: Physical Science, Earth Science
Type: Utility
Grade Level: 7 - A
Minimum System Requirements:
CAV Laser Disc Player
Television or Video Monitor
Optional: Microcomputer and Laser Disc player interface

Description:

Greetings from Earth contains several thousand images of the Earth taken from Landsat. The printed index allows the user to identify and search images of states and geographic locations within states. Also, the index includes some introductory information about the Landsat system. In addition to the Landsat images, *Greetings from Earth* contains Earth observation imagery from Seasat, Nimbus, the Space Shuttle Imaging Radar, Shuttle photography, and from the National High Altitude Photography program. A music video of a satellite retrieval from Shuttle mission 51-A completes the disc.
Components: One single-sided video disc and image directory
Producer: Optical Data Corporation
Vendor: Optical Data Corporation, MECC, Ztek
Cost: $40.00

Title: *Mars & Beyond*

Copyright:
Subject: Astronomy
Application: Science
Type: Utility
Grade Level: 7 - A
Minimum System Requirements:
CAV Laser Disc Player
Television or Video Monitor
Optional: Microcomputer and Laser Disc player interface

Description:

Mars and Beyond contains imagery from the *Voyager* 1 and 2 missions to Jupiter and Saturn. Also included are images from the Viking Lander as transmitted from the surface of Mars. *Mars and Beyond* includes a 28 minute video produced by the NASA Jet Propulsion Laboratory entitled "Voyager."
Components: One CAV video disc and image directory
Producer: Optical Data Corporation
Vendor: Optical Data Corporation
Cost: $40.00

Title: *National Air and Space Museum: Archival Video Disc 1*

Copyright: 1983
Subject: Aeronautics
Application: Science
Type: Utility
Grade Level: 9 - A
Minimum System Requirements:
CAV Laser Disc Player
Television or Video Monitor

Description:

This is the first in the National Air and Space Museum's archival video disc series. The disc consists of nearly 100,000 color and black and white photographs. Photographs on the disc are taken from the archives of the National Air and Space Museum. The images include photos of U.S. and foreign aircraft listed alphabetically by manufacturer. Both military and civilian aircraft are included. A hard copy index is provided giving general information about the images.
Components: One two-sided CAV video disc
Features: Photographs are copyrighted; assistance in obtaining photographs or copyright permission can be obtained from the National Air and Space Museum
Producer: National Air and Space Museum; Records Management Division
Vendor: National Air and Space Museum
Cost: $46.50 plus $1.50 for postage and handling

Title: *National Air and Space Museum: Archival Video Disc 2*

Copyright: 1984
Subject: Aeronautics
Application: Science
Type: Utility
Grade Level: 9 - A
Minimum System Requirements:
CAV Laser Disc Player
Television or Video Monitor

Description:

This is the second in the National Air and Space Museum's archival video disc series. The disc consists of nearly 100,000 color and black and white photographs. Photographs on the disc are taken from the archives of the National Air and Space Museum. Images include biographical photos of persons involved in the development of aviation, as well as photos of aircraft, balloons, airships, air meets, aeronautical communications, simulators, aircraft carriers, and aviation museums. Both a hard copy and on-disc index are provided giving general information about the images.
Components: One two-sided CAV laser disc, index booklet
Features: Photographs are copyrighted; assistance in obtaining photographs or copyright permission can be obtained from the National Air and Space Museum
Producer: National Air and Space Museum; Records Management Division
Vendor: National Air and Space Museum
Cost: $46.50 plus $1.50 for postage and handling

Title: *National Air and Space Museum: Archival Video Disc 3*

Copyright: 1985
Subject: Aeronautics
Application: Science
Type: Utility
Grade Level: 9 - A
Minimum System Requirements:
CAV Laser Disc Player
Television or Video Monitor

Description:

This is the third in the National Air and Space Museum's archival video disc series. The disc consists of approximately 100,000 color and black and white photographs. Photographs on the disc are taken from the United States Air Force's photography collection of World War II era aircraft utilized overseas and of aircraft used in the United States prior to 1954. The thousands of aircraft shown on this disc represent most of the craft used by the U.S. during the war. Also shown are images of electronics work, radar installation, medical support, and facility construction. The photographs were shot in a variety of locations around the world. Both a hard copy and on-disc index are provided giving general information about the images.
Components: One two-sided CAV laser disc, index booklet
Features: Photographs are copyrighted; assistance in obtaining photographs can be obtained from the National Air and Space Museum
Producer: National Air and Space Museum; Records Management Division
Vendor: National Air and Space Museum
Cost: $46.50 plus $1.50 for postage and handling

Title: *National Air and Space Museum: Archival Video Disc 5*

Copyright: 1986
Subject: Aerospace
Application: Science
Type: Utility
Grade Level: 9 - A
Minimum System Requirements:
CAV Laser Disc Player
Television or Video Monitor

Description:

This CAV video disc contains an archival collection of the National Aeronautics and Space Administration's photography collection. Nearly 100,000 photographs, both black and white and color, are included. There are no movie segments. Information on how to obtain transparencies, slides, or prints of the photography is provided.The historical period of the photos in the collection ranges from the founding of NASA in 1958 to activities conducted in 1986. Photos from all piloted missions beginning with Mercury and extending through Space Shuttle missions are included. Also included are photos of satellites, launch vehicles, NASA facilities, and planetary probes. Photographs of NASA astronauts and other personnel are provided. Earth resources photography taken by a 70 mm camera aboard the Space Shuttle is included.
Components: One 12 inch CAV video disc, 73 page photography index
Features: Photography is public domain; information on how to obtain transparencies, slides, or prints of the photography is provided
Producer: National Air and Space Museum; Records Management Division
Vendor: National Air and Space Museum
Cost: $46.50 plus $1.50 for shipping & handling

Title: *Shuttle Downlink: Repair of Solar Max*

Copyright: 1984
Subject: Aerospace Satellites
Application: Science
Type: Utility
Grade Level: 9 - A
Minimum System Requirements:
CAV Laser Disc Player
Television or Video Monitor
Optional: Microcomputer, Laser Disc player interface, and software

Description:

This disc chronicles four Space Shuttle missions, STS-8, STS-9, STS-11 (mission 41-B), and STS-13 (mission 41-C). The disc includes extensive photographs of the Earth from the Shuttle as well as photography and video of mission activities. Highlights include the first flight of Spacelab, the launch of a Tracking and Data Relay Satellite, the first flight test of the Manned Maneuvering Unit, and the retrieval and repair of the Solar Maximum satellite. The image directory provides explanatory notes on the imagery.
Components: One double-sided CAV video disc, image directory
Producer: Optical Data Corporation
Vendor: Optical Data Corporation, MECC, Ztek
Cost: $40.00

Title: *Space Shuttle Mission Reports: STS- 5, 6, & 7*

Copyright: 1983
Subject: Aerospace
Application: Science
Type: Utility
Grade Level: K - A
Minimum System Requirements:
CAV Laser Disc Player
Television or Video Monitor
Optional: Microcomputer, Laser Disc player interface, and software

Description:

This disc contains both photography and video from three Space Transportation System missions, STS- 5, 6, and 7. For each mission, the disc includes supplementary images of such items as the mission patch, statement of mission objectives, crew photo, and prelaunch activities. Onboard mission video includes the launch of several communication satellites, including the first Tracking and Data Relay Satellite (TDRS), astronauts describing student experiments and explaining physics concepts, launch and landing events, and extra-vehicular activities. Highlights of these missions include the first TDRS launch, the first American woman in space, and the first flight of the Shuttle Pallet Satellite (SPAS). An image directory includes a description of each photograph and a synopsis of each video segment.
Components: One double-sided CAV video disc, image directory
Features: The disc is composed of public domain imagery provided by NASA
Producer: Optical Data Corporation
Vendor: Optical Data Corporation, MECC, Ztek
Cost: $40.00

Title: *The Sun*

Copyright: 1984
Subject: Astronomy
Application: Science
Type: Utility
Grade Level: 10 - A
Minimum System Requirements
CAV Laser Disc Player
Television or Video Monitor
Optional: Microcomputer, Laser Disc player interface, and software

Description:

The Sun consists of observation imagery from a variety of observatories. In addition to the imagery of the Sun, there are graphics which define features of the Sun, give pertinent physical data, and explain solar events. Also, images of many observatories, such as Skylab, the Solar Maximum Satellite, and the Orbiting Solar Observatories, are included. Sun imagery includes sunspots, solar flares, and eclipses. A comprehensive image directory provides explanatory notes for each still image and a description of each video segment. Side two of the disc is devoted to the 28 minute video, *The Universe*, which was produced under the direction of NASA. Topics covered within *The Universe* include the formation of the Universe, the Sun, planetary science, the Milky Way galaxy, stellar evolution, and extraterrestrial life including the SETI program.
Components: One double-sided video disc, image directory
Producer: Optical Data Corporation
Vendor: Optical Data Corporation, Ztek
Cost: $400.00

Section 4: SpaceLink

NASA SpaceLink is a 24-hour computer information database developed to serve teachers and other educators. SpaceLink allows educators access to information about aeronautics and space research that is both current and relevant to their classrooms.

SpaceLink is managed by the NASA Marshall Space Flight Center for NASA's Educational Affairs Division. It is a dynamic system that is updated daily. The system is menu-driven and user-friendly so that someone with little computer experience can put it to full use.

SpaceLink features current NASA News Releases, information on developments in aviation and space research, Space Shuttle launch schedules, future and historical program information, announcements of educational projects and workshops, classroom materials, and lesson plans for classroom use.

To communicate with SpaceLink an educator needs the following equipment:

Microcomputer
Modem
Long Distance Telephone Line
Communications Software
PRINTER (Optional)

The SpaceLink service is free but unless you live within the local dialing zone of the Marshall Space Flight Center, you will have to pay long distance telephone tolls.

To access SpaceLink, use your computer communications software to call the following number:

(205) 895-0028

First time users will be asked to register for the service and choose a personal code to use during future communications. An abridged sample communications sequence is included below. Entries by the user are printed in italics.

```
W E L C O M E

to

NASA SPACELINK

A Space-Related Informational Database
Provided by the NASA Educational Affairs Division
```

```
Operated by the Marshall Space Flight Center
On a Data General ECLIPSE MV7800 Minicomputer

******IMPORTANT!******
Do not press RETURN until you have read the following information.
You are about to be asked to provide a Username and a Password.
If this is your first call to NASA Spacelink, Enter NEWUSER as your
Username and enter NEWUSER as your Password.
If you have called before, enter your assigned Username and Password.
You may now press RETURN, or
To redisplay this message press CONTROL-D.

Username: NEWUSER
Password: (NEWUSER. Does not appear on screen.)

Last previous logon    30-Jun-88    9:21:24
NASA/SPACELINK    REGISTRATION    Revision:1.02.00.00
```

(Information about SpaceLink, not reproduced here, follows.)

How To Use NASA SpaceLink

NASA SpaceLink is a menu-driven data base. After this introduction, and immediately after you log on in the future, you will be given access to the NASA SpaceLink Main Menu, which is a list of the general topics contained in the system. To receive information from NASA SpaceLink, type the number of a menu item likely to contain material of interest, and press your computer's carriage return key (or equivalent). You will find one or more sub-menus under each item in the Main Menu.

Every SpaceLink sub-menu offers the options of returning to the previous menu (item 0) or returning to the Main Menu (item 1).

In brief, here are the keys you can use to control operation of NASA SpaceLink:

Key	Effect
RETURN	Causes text to resume scrolling
C	Causes text to scroll continuously to end
S	Causes text to stop scrolling and returns user to previous menu
Ctrl/S	Causes text to pause

Ctrl/Q	Causes text to resume scrolling after being stopped by Ctrl/S
Ctrl/H	Deletes typing mistakes (Your computer's left arrow or delete key may generate Ctrl/H.)
Ctrl/X	Abort an XMODEM file transfer

ID AND PASSWORD ASSIGNMENT

(You will be asked to create a personal user name and password to use with all future contacts with SpaceLink.)

NASA SpaceLink Main Menu
(The main menu and several sample submenus appear below.)

1. Log Off NASA SpaceLink
2. NASA SpaceLink Overview
3. Current NASA News
4. Aeronautics
5. Space Exploration: Before the Shuttle
6. Space Exploration: The Shuttle and Beyond
7. NASA Installations
8. NASA Educational Services
9. Materials for Classroom Use
10. Space Program Spinoffs

Enter your choice: (*9*)

Materials for Classroom Use

0. Previous Menu
1. Main Menu
2. Living In Space Activities
3. Space Science Activities
4. Commercially Available Software for Aerospace Education
5. How to Obtain NASA Educational Publications
6. Astronomy Information
7. Very Lo-Res "Graphics"
8. Film List
9. Careers in Aerospace
10. Metrics in Space
11. Computer Programs

```
   Enter your choice:   (2)

Living in Space

0..Previous Menu
1..Main Menu
2..Food Lesson Plans
3..Clothing Lesson Plans
4..Health Lesson Plans
5..Housing Lesson Plans
6..Communication Lesson Plans
7..Working Lesson Plans
8..Space Station Research & Design, 7-12

   Enter your choice:   (2)

Living in Space

Food Lesson Plans

0..Previous Menu
1..Main Menu
2..Background, 1-3
3..Background, 4-6
4..Background, 7-12
5..Grades 1-3
6..Grades 4-6
7..Grades 7-8
8..Grades 9-12
```

(At the completion of information access, the main menu reappears permitting the user to log off the system.)

```
      EXIT THE SYSTEM? (Y/N)  Y

      LEAVE A MESSAGE FOR NASA?  (Y/N)  N

Thank you for calling NASA/SPACELINK.  Call again soon!
```

Vendor List

Academic Hallmarks
P.O. Box 998
Durango, CO 81301
800-321-9218
Knowledge Master - Astronomy

Aquarius People Materials, Inc.
P.O. Box 128
Indian Rocks Beach, FL 33535
800-338-2644
Skies Above - The Water Below

Astro Link
P.O. Box 1978
Spring Valley, CA 92077
619-698-9174
Indoor Astronomy

Astromedia Corp.
P.O. Box 92788
Milwaukee, WI 53202
414-276-8547
Stars.Bas

Astronomical Society of the Pacific
Selectory Sales
1290 24th Avenue
San Francisco, CA 94122
Atari Planetarium
Sky Travel

Bergwall Educational Software, Inc.
106 Charles Lindberg Blvd.
Uniondale, NY 11553
800-645-1737 (In NY call collect 516-222-1130)
Our Atmosphere - The Science Professor Unit 5
Planet Hopping - The Science Professor Unit 7
The Solar System - The Science Professor Unit 6

Broderbund Software
17 Paul Drive
San Rafael, CA 94903
414-492-3500
Physics

Carolina Biological Supply Company
2700 York Road
Burlington, NC 27215
800-334-5551 (In NC call 800 632-1231)
Astronomy Keyword
The Observatory

COMPress
P.O. Box 102
Wentworth, NH 03282
800-221-0419
Journey To The Stars
World Clock

COMPU-TATIONS, Inc.
P.O. Box 502
Troy, MI 48099
800-345-2964 (In MI call 313-689-5059)
Course Master - Begin.Astronomy

Computer Assist Services
1122 13th Street
Golden, CO 80401
303-279-8073
The Sky

Conduit
The University of Iowa
Oakdale Campus
Iowa City, IA 52242
319-335-4100
Stargazing

Cross Educational Software
1802 N. Trenton St.
P.O. Box 1536
Ruston, LA 71270
318-255-8921
Gravity
Solar System Astronomy
Stellar Astronomy

Cygnus
P.O. Box 69052
Station K
Vancouver, B.C.
Canada
V5K 4W3
Astrolab

D.C. Heath
125 Spring Street
Lexington, MA 02173
617-862-6650
Traveling Through The Solar System

Decision Development Corp.
2680 Bishop Drive
Suite 122
San Ramon, CA 94583
415-830-8896
Space - Understanding Our Solar System Science #4

Delapress, Inc.
Route 1 Highway 304
Delaphlaine, AK 72425
501-249-3392
Ceres: A Space Odyssey

Diversified Educational Enterprises, Inc.
725 Main Street
Lafayette, IN 47901
317-742-2690
Mind Games - Space

The Walt Disney Co.
500 South Buena Vista Street
Burbank, CA 91521
800-423-2555
Mickey's Space Adventure
Galactic Prospector

Dynacomp, Inc.
Attn: Order Department
P.O. Box 18129
Rochester, NY 14618
800-828-6772 (In NY call 716 671-6160)
Astroview
Space Base Star Atlas

Earthware Computer Services
P.O. Box 30039
Eugene, OR 97403
503-344-3383
Starsearch

Educational Activities, Inc.
1937 Grand Ave.
Baldwin, NY 11510
800-645-3739
Astronomy: Stars for All Seasons
The Earth Through Time and Space: The Earth Science Series

Educational Images Ltd.
P.O. Box 3456
West Side Station
Elmira, NY 14905
800-527-4264
Telescopes
Eclipses and Phases of the Sun and Moon
The Planetary Guide
The Solar System
The Star Gazer's Guide
Time and Seasons

Educulture
1 Dubuque Plaza
Dubuque, IA 52001
800-553-4858 (In IA call collect 319-557-9610)
Satellite Orbits - Newton

EduWare Services
185 Berry Street
San Francisco, CA 94107
415-546-1937
Tranquility Base

Electronic Arts
1820 Gateway Drive
San Mateo, CA 94404
415-571-7171
Chuck Yeager's Advanced Flight Simulator
Earth Orbit Stations
Starflight

Elton Software
P.O. Box 649
Lafayette, CO
303-665-3444
MacStronomy

Estes Industries
1295 H Street
Penrose, CO 81240
303-373-6565
Flight: Aerodynamics of Model Rockets
Astrocad: Performance Analysis for Model Rockets
In Search of Space: Intro to Model Rocketry
The Physics of Model Rocketry

Federal Aviation Administration
Department of Transportation
Office of Public Affairs (APA-6)
Attn: Michael E. Wayda
800 Independence Avenue
Washington, DC 20591
202-426-3485
Aviation and Our Environment
Navigation and Flight Planning
Principles of Flight

Final Frontier Software
18307 Burbank Blvd., Suite 108
Tarzana, CA 91356
800-992-1125 Ext. 100 (in CA: 818-996-0431)
Space M+A+X

Focus Media, Inc.
839 Stewart Avenue
P.O. Box 865
Garden City, NY 11530
800-645-8989 (In NY call collect 516-794-8900)
The Earth and Moon Simulator
Planetarium on Computer: Your Solar System
Your Universe - The Solar System

GraySoft
P.O. Box 5456
Stn "F", Ottawa
Canada
K2C 3J1
613-728-7566
Astro-Macronomer

Grolier Electronic Publishing, Inc.
Sherman Turnpike
Danbury, CT 06816
800-858-8858
Adventures in Space

HRM Software
175 Tompkins Avenue
Pleasantville, NY 10570
800-431-2050
Glidepath

Houston Museum of Natural Sciences
Dr. Carolyn Sumners
Director of Astronomy and Physics
One Hermann Circle Drive
Houston, TX 77030
Astrografix
Lost in the Universe

Hubbard
P.O. Box 104
Northbrook, IL 60062
800-323-8368 (In IL call collect 312-272-7810)
Astro-Computer (Astronomy) Data Bytes
Computer Star Games - Stellar 28
Computer Star Finder

IBM
Attn: Educational Systems
Department 8WH
P.O. Box 2150
Atlanta, GA 30035
800-IBM-2468
Investigating Gravitational Force

Interstel Corp.
P.O. Box 57825
Webster, TX 77825
713-333-3909
SOLARSIM - The Solar System Simulation Program

Interstellar
4921 Mackelman Drive
Oklahoma City, OK 73135
Interstellar

January Productions
249 Goffle Road
Hawthorne, NJ 07507
201-423-4666
Our Moon
Our Solar System
Our Sun
The Planets

Light Software
1850 Union Street #252
San Francisco, CA 94123
415-493-3631
PC Planetarium

Little Shaver Software
267 Bel Forest Drive
Belleair Bluffs, FL 91320
805-499-1407
Our Solar System
Our Sun

MECC
3490 Lexington Avenue North
St. Paul, MN 55126
(800) 228 3504
(Software)
Skylab
(video discs)
Apollo 17
Encounters
Greetings from Earth
Mars & Beyond
Shuttle Downlink
Space Shuttle Mission Reports: STS 5,6,7

Mindscape School Software, Inc.
3444 Dundee Rd
Northbrook, IL 60062
800-942-7315
The Halley Project - A Mission in our Solar System

John Mosley
13623 Sylvan
Van Nuys, CA 90027
Apple Public Domain Astronomy Software

Mousetrap Software
336 Coleman Drive
Monroeville, PA 15146
412-372-9004
Stargazer

National Air and Space Museum
Information Management Division
Smithsonian Institution
Washington, DC 20560
(202) 357-3133
(video discs)
National Air and Space Museum: Archival Video Disc 1,2,3,5

NASA Jet Propulsion Laboratory
Educational Outreach Program
180-205
4800 Oak Grove Drive
Pasadena, CA 91103
818-354-6916
Microgravity and GO

NASA Teacher Resource Centers
Refer to special list — APPENDIX B
Apple Public Domain Astronomy Software
Astrografix
Introduction to the Hubble Space Telescope
Lost in the Universe
Space Shuttle Clip Art

Odyssey Magazine
Order Department
1027 N. 7th Street
Milwaukee, WI 53233-1471
414-272-2060
Project Space Station

Optical Data Corporation
Box 97
Florham Park, NJ 07932
(800) 524 2481
(201) 377 0302 (in New Jersey)
(video discs)
Apollo 17
Encounters
Greetings from Earth
Mars & Beyond
Shuttle Downlink
Space Shuttle Mission Reports: STS- 5,6,7
The Sun
Astronomy

Optimum Resource, Inc.
10 Station Place
Northfolk, CT 06058
203-542-5553
Exploring Tables and Graphs

picoScience
415123 Chadbourne Drive
Fremont, CA 94539
415-498-1095
Superstar

Prentice Hall Allyn & Bacon
200 Old Tappan Road
Old Tappan, NJ 07675
800-524-2349 (in NJ call 201-592-2992)
The Astronomy Disk
Interplanetary Travel
Life Cycles of Stars
Newton's Third Law
The Physics Disk
Simon
Unprintable Physics

Queue
562 Boston Avenue
Bridgeport, CT 06610
800-232-2224 or 203-335-0908
Celestial Simulation
Planetary Motion
Wonders of the Solar System
History of Space Flight

Rand McNally
P.O. Box 7600
Chicago, IL
312-673-9100
Time and Seasons

Right on Programs
1737 Veteran's Highway
Central Islip, NY 11722
516-348-1577
The Solar System

SRA
P.O. Box 5380
Chicago, IL 60680
312-984-5380
Astronomy for Everyone
Experiments - Exploring the Solar System

S&T Software Service
Division of American Only, Inc.
13361 Frati Lane
Sebastopol, CA 95472
707-874-2352
Celestial Basic
Halley's Comet on Your Home Computer

School Management Arts, Inc.
P.O. Box 1
Boston, MA 02195
617-969-0966
The Daily Planet

Science Software
7370 S. Jay St.
Littleton, CO 80123
303-972-4020
Aeronautics Disk
Astronomy Disk
Earth Satellites

Simpletech, Inc.
1852 Century Place
Suite 130
Atlanta, GA 30345
404-320-9252
Shuttle Designer

Software City
P.O. Box 11082
Station H
Nepean, Ontario
K2H 7T8
613-225-8847
Star Cal 3

SouthWest EdPsych Services, Inc.
P.O. Box 1870
Phoenix, AZ 85001
602-253-6528
The Moon and Its Phases

Spectrum Holobyte
2061 Challenger Drive
Alameda, CA 94501
415-522-3584
Telestar - Level II
Lunar Explorer
Orbiter

Stratus Software
321 S. Shore Blvd.
Buffalo, NY 14218
Star Base II
Clock
Timebase

Studio Zero, Inc.
6212 Samuel Boulevard
Suite 153
Dallas, TX 75228
800-752-9222 X933 Ask For Studio Zero
Orbital Mech

Sunburst Communications Inc.
39 Washington Avenue
Pleasantville, NY 10570-9971
800-431-1934 (In NY call 800-221-5912)
Explorer Metros
Sir Isaac Newton's Games
Astronomy Data Bases
Planetary Construction Set

subLOGIC Corporation
713 Edgebrook Drive
Champaign, IL 61820
800-637-4983
Flight Simulator II
Jet

Tech-Link Incorporated
5075 Bob-O-Link Northwest
North Canton, OH 44720
216-494-5322
Kepler
Sat Plot
Star
Twilight

U. S. Naval Observatory
Nautical Almanac Office
Code FA
Washington, DC 20390-5100
Floppy Almanac

Ventura Educational Systems
3440 Brokenhill Street
Newbury Park, CA 91320
805-499-1407
All About the Solar System

Vernier Software
2920 S. W. 89th Street
Portland, OR 97225
503-297-5317
Ray Tracer
Orbit III

Visionary Software
P.O. Box 1063
Midland, MI 48641-1063
517-835-9025
Star Chart

Zephyr Services
306 S. Homewood Ave.
Pittsburgh, PA 15208
412-241-5915
Astro-Aid
Astro-Finder
Astro Base
Astro Calc
Astrostell
Cometwatch
Eclipse Master
Moontracker
Nitemapper
Sun Tracker

Ztek Company
Box 54790
Lexington, KY 40555
800-247-1603
(video discs)
Apollo 17
Encounters
Greetings from Earth
Mars & Beyond
Shuttle Downlink
Space Shuttle Mission Reports: STS- 5,6,7
The Sun, Astronomy

Appendix B

NASA Teacher Resource Centers

NASA maintains collections of video tapes, laser video disks, slides and printed materials for use by educators. These collections, located in Teacher Resource Centers in each of the NASA Educational Service Regions, are available for perusal by educators. Each center features duplicating equipment for copying video tapes, audio cassette tapes, 35 millimeter slides, computer software, and lesson plans. In addition, NASA educational publications including curriculum guides, are available. Contact the Teacher Resource Center serving your state to arrange for educational material assistance.

If you live in	Contact
Alaska Arizona California Hawaii Idaho Montana Nevada Oregon Utah Washington Wyoming	NASA Ames Research Center Attn: Teacher Resource Center Mail Stop 204-7 Moffett Field, Ca 94035 415-694-6077 NASA Jet Propulsion Laboratory Attn: Teacher Resource Center JPL Educational Outreach Mail Stop: CS-530 Pasadena, CA 91109 818-354-6916
Connecticut Delaware District of Columbia Maine Maryland Massachusetts New Hampshire New Jersey New York Pennsylvania Rhode Island Vermont	NASA Goddard Space Flight Center Attn: Teacher Resource Laboratory Mail Stop: 130-3 Greenbelt, MD 20771 301-344-8981

Colorado Kansas Nebraska New Mexico North Dakota Oklahoma South Dakota Texas	NASA Lyndon B. Johnson Space Center Attn: Teacher Resource Room Mail Stop: AP-4 Houston, TX 77058 713-483-8696
Florida Georgia Puerto Rico Virgin Islands	NASA John F. Kennedy Space Center Attn: Educators Resource Laboaratory Mail Stop: ERL Kennedy Space Center, FL 32899 305-867-4090 or 9383
Kentucky North Carolina South Carolina Virginia West Virginia	NASA Langley Research Center Attn: Langley Teacher Resource Center Mail Stop: 146 Hampton, VA 23665-5225 804-865-4468
Ilinois Indiana Michigan Minnesota Ohio Wisconsin	Lewis Research Center Attn: Teacher Resource Center Mail Stop: 8-1 Cleveland, OH 44135 216-267-1187
Alabama Arkansas Iowa Lousiana Missouri Tennessee	Alabama Space and Rocket Center Attn: Teacher Resource Room Tranquility Base Huntsville, AL 35807 205-544-5812
Mississippi	NASA John C. Stennis Space Center Attn: Teacher Resource Center Building 1200 Stennis Space Center, MS 39529 601-688-3338

Index

Adventures In Space 64
Aeronautics Disk 7
Aerodynamics of Model Rockets 8
All About The Solar System 17
Apollo 17 (video disc) 68
Apple Public Domain Software 17
Astro-Aid 18
Astro-Computer (Astronomy) Data Bytes 18
Astro-Finder 18
Astro-Macronomer 19
Astrobase 19
Astrocalc 20
ASTROCAD: Performance Analysis for Model Rockets 59
Astrografix 20
Astrolab 20
Astronomy (video disc) 69
Astronomy Data Bases 21
Astronomy Disk 21
Astronomy Disk, The 22
Astronomy For Everyone 22
Astronomy Keyword 65
Astronomy: Stars for All Seasons 22
Astrostell 23
Astroview 65
Atari Planetarium 65
Aviation and Our Environment 7
Celestial Basic 23
Celestial Simulation 24
Ceres: A Space Odyssey 24
Chuck Yeager's Advanced Flight Trainer 8
Clock 65
Cometwatch 24
Computer Star Games - Stellar 28 25
Computer Star Finder 25
Course Master - Begin.Astronomy 26
Daily Planet, The 26
Earth and Moon Simulator, The 27
Earth Orbit Stations 52
Earth Satellites 62
Earth Through Time and Space, The: The Earth Science Series 27
Eclipse Master 28
Eclipses and Phases of the Sun and Moon 28
Encounters (video disc) 69
Experiments - Exploring the Solar System 28
Exploring Tables and Graphs 59
Explorer Metros 12
Flight : Aerodynamics of Model Rockets 8
Flight Simulator II 8

Floppy Almanac 29
Galactic Prospector 52
Glidepath 9
Gravity 12
Greetings from Earth (video disc) 70
Halley's Comet Locator 65
Halley's Comet On Your Home Computer 29
Halley Project - A Mission in Our Solar System, The 53
History of Space Flight 53
In Search of Space - Introduction To Model Rocketry 60
Indoor Astronomy 30
Interplanetary Travel 30
Interstellar 65
Introduction To The Hubble Space Telescope 31
Investigating Gravitational Force 65
Jet 10
Journey To The Stars 65
Kepler 65
Knowledge Master - Astronomy 31
Life Cycles of Stars 32
Lost In The Universe 32
Lunar Explorer 54
Macstronomy 33
Mars and Beyond (video disc) 70
Microgravity - An Operation Liftoff Project/GO - Gravity and Orbits 13
Mickey's Space Adventure 33
Mind Games - Space 34
Moon and Its Phases, The 65
Moontracker 34
National Air and Space Museum Archival Video Disc 1 (video disc) 70
National Air and Space Museum Archival Video Disc 2 (video disc) 71
National Air and Space Museum Archival Video Disc 3 (video disc) 71
National Air and Space Museum Archival Video Disc 5 (video disc) 72
Navigation and Flight Planning 10
Newton's Third Law 13
Nitemapper 35
Observatory, The 65
Orbit II 62
Orbital Mech 54
Orbiter 55
Our Atmosphere - The Science Professor Unit 5 35
Our Moon 35
Our Solar System (January Productions) 36
Our Solar System (Little Shaver Software) 36
Our Sun (Little Shaver Software) 36
Our Sun (January Productions) 37
PC Planetarium 37
Physics 14

Physics Disk, The 14
Physics of Model Rocketry, The 60
Planet Hopping - The Science Professor Unit 7 38
Planetarium On Computer: Your Solar System 38
Planetary Construction Set 39
Planetary Guide, The 40
Planetary Motion 40
Planets, The 40
Principles of Flight 11
Project Space Station 56
Ray Tracer 14
Sat Plot 63
Satellite Orbits - Newton 63
Shuttle Designer 61
Shuttle Downlink: Repair of Solar Max (video disc) 72
Simon 15
Sir Isaac Newton's Games 15
Skies Above - The Water Below 41
Sky Lab 42
Sky, The 41
Sky Travel 65
Solar System, The (Educational Images) 42
Solar System, The (Right On Programs) 43
Solar System, The - The Science Professor Unit 6 43
Solar System Astronomy 44
SOLARSIM - The Solar System Simulation Program 44
Space Base Star Atlas 65
Space Data Bases 56
Space M+A+X 57
Space Shuttle Clip Art 58
Space Shuttle Mission Reports: STS 5,6, &7 (video disc) 73
Space-Understanding Our Solar System: Science #4 45
Star 65
Star Base II 65
Star Cal 3 45
Star Gazer's Guide, The 46
Star Search 64
Starchart 46
Stargazer 47
Stargazing 47
Starflight 64
STARS.BAS, STARS.DAT 65
Stellar Astronomy 48
Sun, The (video disc) 73
Suntracker 48
Superstar 65
Telescopes 16
Tellstar - Level II 49

Time Base 65
Time and Seasons (Educational Images) 49
Time and Seasons (Rand McNally) 50
Tranquility Base 58
Traveling Through the Solar System 50
Twilight 50
Unprintable Physics 16
Wonders of the Solar System 51
World Clock 65
Your Universe - The Solar System 51

END

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